THE HUMAN MIND

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PSYCHOLOGY

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THE HUMAN MIND

by

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PREFACE

It is obvious that in writing a book of the type contemplated in the following pages one has to use a pair of scissors and the gluepot much more frequently than the pen. I hope that I have at least displayed some originality in wielding these instruments. It is equally obvious that in a book of this kind the author's indebtedness to other writers far exceeds the acknowledgments specifically made in the body of the text. My own first acquaintance with psychology was made through R. S. Woodworth's well-known book, and its influence can be easily traced in almost every chapter of the present volume. Other books that I have extensively used are *A Hundred Years of Psychology*, by J. C. Flugel, *Introduction to General Psychology*, by Gardner Murphy and *Readings in General Psychology*, by Robinson and Robinson.

Originally meant for Indian students, I am glad that this book is now to have a wider circle of readers as part of Hutchinson's University Library. Generations of young men of my country have been nurtured by excellent text-books written in England and America. I hope I will not be considered too fanciful if I look upon this little effort of mine as in some measure repaying the debt.

In conclusion I wish to express my deep sense of gratitude to Dr. J. C. Flugel for sparing much of his valuable time to go through the manuscript and for making many helpful suggestions and criticisms.

S. P. Adinarayan.

Magdalen College,
Oxford, 1949.

CHAPTER I

INTRODUCTION

1. What is Psychology?

Psychology is a systematic body of knowledge about the mind or a study of mental life. Where and what is the mind? People from the ancient times downward have attempted to locate the mind in different parts of the body. The most common view is that the mind is in the brain. The famous Indian physician Charaka puts it in the heart. Descartes, the father of modern philosophy, suggests the pineal gland as its possible abode. The ancient Egyptians, we are told, thought that the mind dwelt in the stomach. Any attempt to localize the mind within the body is bound to be futile, because the mind is not a thing but a function. It is everywhere and yet nowhere. Though dependent on the brain yet it is different from it. The brain is a machine, the mind is the product of the working of that machine. We think by means of the brain but the thoughts themselves comprise the mind. The brain is material, the mind is immaterial. The brain is composed of nerves and nerve centres, the mind expresses itself in feelings, emotions, attention, memory, will, intelligence and such other phenomena.

If the mind then is not a thing but a function that expresses itself in diverse ways, is it possible to make a systematic study of it? Many people would say, no. For has not the mind been the riddle of the ages, an enigma that has baffled all attempts at analysis. It is notoriously free, it can travel anywhere, stone walls cannot bind it nor iron bars subdue it. Poets, philosophers and thinkers have done much to build up this kind of a tradition about the freedom of the mind. Psychologists, however, believe that the mind can be studied scientifically and systematically. For unless they believe this, it is useless to proceed any further. At the same time they recognize that their task is an extremely difficult one—far more difficult than that

of the physical sciences like botany, physics or chemistry. For their subject matter is right before our eyes; it can be touched, handled and examined. But the analysis of the mind is a much more complicated affair than the analysis of matter. Thoughts cannot be put into test-tubes.

2. Ways of Studying the Mind

There are two ways in which the mind can be studied—(1) direct and (2) indirect. The direct method is known as *introspection* and is one of the oldest methods of psychology. It is a subjective method where each one studies his own mental states. The indirect method is an objective method where we study not ourselves but another person. It is impossible for us to get behind the mind of the other person. But fortunately the mind never acts in isolation. Every mental state leaves a trace on the body. Body and mind act and react upon each other. Bodily changes accompany mental conditions, bodily states affect our mental outlook. To take two simple examples—during the mental state of anger the bodily process of digestion comes to a stop; the pleasant and comfortable feeling following a good meal creates a mental state which is characterized by good humour and optimism. So in the indirect method we study the effects of the mind on the body and not the mind itself.

3. Psychology as a Science

We have defined psychology as a systematic body of knowledge about the mind. The name science is generally given to such a systematic body. Is psychology then, a science? Besides being a system, a science aims at prediction and control. The geologist predicts earthquakes and the physicist controls electric power. Lastly a science uses instruments of precision and weighs and measures its subject-matter accurately. If psychology is to claim the status of a science it must fulfil all these conditions. Psychological knowledge is becoming every day more and more systematic. The discovery of many delicate instruments has made it possible to measure accurately some of the bodily changes that accompany certain mental states. As far as prediction and control are concerned, it must be

confessed that the psychologist has very little to boast of. But a school of psychologists, known as the behaviourists, is trying to fit the whole of human behaviour into a stimulus-response scheme. They hope one day to predict what the response of an individual would be, given the stimulus. At present, however, this is but a distant hope. Taking all this into consideration, we may well hesitate to call our science a full-fledged one. It is an infant science showing healthy tendencies of growth.

All sciences are nothing but the growth and systematization of the knowledge possessed by the man in the street. Psychology is no exception to this rule. All of us have some knowledge of what passes in our minds and in the minds of our fellow-beings. Unless we have this knowledge it is impossible for us to get on in society. We are constantly trying to gather from the outward behaviour of our friends, by their gestures, attitudes, words or actions, some knowledge of what is passing on in their minds. We have some idea of their habits, emotions, thoughts, feelings and will. This knowledge is enough for us for practical purposes, but it is vague, incomplete and unsystematic. It is the task of psychology to make this knowledge systematic and complete.

When psychology becomes a science it would be a *natural* and not a *normative* science. A natural science is interested in its subject matter for its own sake, whereas a normative science has a norm or ideal to which it relates its subject matter. Ethics is a normative science. It has an ideal—*the summum bonum* and it seeks to evaluate conduct from the point of view of this ideal. So also logic, which is concerned with true thinking and the avoidance of false or incorrect thinking. On the other hand sciences like physics, chemistry or zoology are all natural sciences. They just examine and analyse their subject matter without any reference to an ideal. Psychology studies mental life as it finds it, without going into questions of right or wrong, truth or falsehood. It studies mental life as revealed in human activity in all its multitudinous manifestations. It draws no lines of distinction. It deals with the abnormal as well as the normal human being. It is interested alike in the thoughts of the sane and the insane, the criminal and the

saint. This is what is meant by saying that the psychological attitude is one of strict moral neutrality. The psychologist does not praise or blame individuals for their acts but merely studies these acts as mental manifestations. His task is to know and to understand but never to pass judgment.

4. Value of a Study of Psychology

It is obvious that a knowledge of the working of the human mind is of the greatest practical value. Such a knowledge will help one in choosing a profession or trade, a hobby or a companion. It will help one to control his intellect, emotion and will, in fact bring in a certain amount of discipline into his life. But one should understand not only his own mind but should also have some idea of what is going on in the minds of others. Psychology helps you to achieve this understanding without which all social intercourse and public life would be well nigh impossible. Such understanding is the basis of that supreme social quality that we call *tact*.

Apart from these general considerations, the practical value of a study of psychology has been specifically proved in many fields of human activity. Researches into the nature of fatigue, the factors involved in attention and vocational guidance, have all resulted in immense benefit to industry and commerce and have brought in a complete revolution in the art of advertisement. Studies in intelligence and intelligence testing have thrown a new light on problems connected with education and the upbringing of the child. During wars the help of the psychologist has been sought with conspicuous success in matters of recruitment. The whole question of crime and punishment is now being viewed from a new angle thanks to the increasing knowledge we have about the mind and its maladjustments. The psychologist can boast of considerable achievement even in the field of therapy or healing and it is being increasingly recognized that certain types of nervous and mental disorders definitely come within his province. Again new light has been thrown on the delicate problem of sex and the causes of sexual disharmony which are at the root of so much married misery.

CHAPTER II

THE RELATION OF PSYCHOLOGY TO OTHER SCIENCES AND PHILOSOPHY: SOME DEFINITIONS

1. Psychology and Biology

Biology is the science of physical life. It is concerned with all living creatures. Psychology studies the mental life of all living creatures. We may therefore say that psychology is part of biology or that it is one of the biological sciences. The science of life includes the science of mental life. Biology can be divided into many branches: (1) zoology, which deals with the structure, habits and growth of animals; (2) physiology, which studies the functions and activities of living things and (3) genetics, the science of heredity, to mention a few. Now we find that certain portions of psychology are closely related to certain portions of biology. Animal psychology and zoology have much in common. They are both interested in the behaviour of animals. Genetic psychology and genetics are both interested in hereditary traits like feeble-mindedness or musical ability.

That part of biology with which psychology is most closely associated is physiology. We have already seen that physiology is interested in the functions and activities of living things, and since psychology studies the mental life of living things, in one sense it is part of physiology. But as a rule we find that physiology is more interested in bodily functions such as digestion, circulation, etc., whereas psychology pays attention to mental functions like memory, intelligence, will, etc. But such a distinction, however, is not a very accurate one. There are many human activities which cannot be classified exclusively as either bodily or mental. We know that the mind and the body are so closely inter-connected that every activity has both a physical and a mental side to it. Speech, for example, involves the movement of the tongue as well as activity in the brain,

but the process of learning to speak is closely connected with the growth of the mind. Or again digestion, though at first sight it may appear to be an exclusively bodily process, is not really so. When a man is angry, the digestive process comes to an end. A state of mental happiness on the other hand aids digestion. At the same time we must grant that certain activities are more pronouncedly bodily and certain others more pronouncedly mental. Under the first group come things like circulation and digestion, and they belong to physiology. Functions like memory or intelligence belong to the second group and therefore are the subject matter of psychology. Roughly speaking, we may say that psychology considers activities that are performed by the individual as a unit whereas physiology is concerned with the activities of the several organs of the individual taken separately.

Psychology and biology are sister sciences. Each science is benefited by the discoveries of the other. They have much subject matter in common but they differ in outlook. The biologist is more interested in the structure and functions of all living organisms; the psychologist is keen on mental life and purposive activity.

2. Psychology and Sociology

Sociology studies the activities of a group of people taken as a whole while psychology studies the activities of individuals. Sociology studies the institutions, ceremonies, customs and other group activities of people whereas psychology is concerned with the individuals that compose these groups. This, however, is a rough distinction that breaks down at many a point. In studying a social phenomenon like an election, for example, the sociologist, in trying to find out why a particular group elected a particular person, must know something about the mentality of each individual voter and must come to the psychologist for this knowledge. Social psychology which is an important branch of psychology is interested in the instinctive basis of group life and the common tendencies or "factors" running through social attitudes like liberalism, religion or race-prejudice. No doubt the emphasis is on the individual

but it is not so much on the individual as such but as a member of a group.

Besides this intimate connection between social psychology and sociology we find that all the social sciences have a psychological side to them. Economics is the science of the production and distribution of wealth, but to understand these matters it is essential that we should know something of the human instincts of acquisition and self-assertion and this knowledge psychology gives us. Politics is the science of government, but it would be foolish to study politics without first knowing why it is that people like to come together in groups and submit to the rule of a single person, and to answer these questions we must turn to the herd instinct and the negative self-feeling of psychology. Lastly, ethics is the science of morality, but no one would be rash enough to study the nature of morality without some acquaintance with the psychological problem of human behaviour and the factors that influence human conduct.

Social psychology thus occupies a middle position between sociology and general psychology. Its object is, as Thouless puts it, "to provide a science of man in his social relationships, by studying the elements in normal adult psychology which affect the formation of social groups and the interactions between individuals in such groups".

3. Psychology and Philosophy

Philosophy may be defined as the science of things in general. It deals with the universe as a whole and tries to discover some ultimate principles behind it like matter, mind or idea. The philosopher is not content to take things as they are, the world as it appears to us, but goes on to try and discover the reality behind its changing phenomena. Each science takes as its subject matter one special bit of the universe, but philosophy does not specialize in this manner. It generalizes to the utmost. Its subject matter is the universe taken as a whole and its aim, to discover a single principle that will explain it.

Why should psychology be grouped under philosophy? While the sciences of plant or animal life or life in general do

not come under it, why should the science of mental life be part of it? Three ways in which philosophy has a special claim on psychology may be considered:

(1) Historically psychology is the outgrowth of philosophy. It was the philosopher that first turned his attention to the nature of the human mind. In particular he was interested in the question of the relation of mind and body. The essence of mind is thought and that of matter, extension or spread-outness. These two things are diametrically opposed to each other and yet influence each other. In seeking to solve this "problem of dualism", the philosopher was naturally led to make a detailed study of the working of the human mind, and thus was born the science of psychology.

(2) Psychology forms an admirable introduction to the study of philosophy. Philosophy is essentially speculative in nature. Here all the resources of the human mind are used to their utmost capacity. For philosophy is nothing but the attempt made by the human mind to pierce behind the external appearance of the world and discover the abiding reality behind it. It is true that we must use our minds in all scientific study. But in other sciences there are always present before us certain objects that we can observe or experiment with. In the study of philosophy, however, we are in the realm of pure thought. There are no external aids to help us, our mind is our sole guide. The philosopher more than anybody else must have a good knowledge of the working of the human mind.

(3) Psychology is very closely connected with certain branches of philosophy like ethics and logic. We have already noted the relation between ethics and psychology. Logic is concerned with the problem of truth and falsity in thought, and it is obvious that to understand this problem we must have some appreciation of the nature of the thought processes, and this forms part of mental life as studied by psychology.

There is now, however, a strong movement among psychologists to get away from all philosophic associations and make their science an independent one. We may here note a few reasons for this "revolt of psychology":

(1) *Nervousness.* Philosophy is an ancient discipline full of dogma and a technique and vocabulary peculiarly its own and

the youthful psychologist is afraid of being swamped by it. Psychology is a young science out on a voyage of discovery. It likes to be free, not to be fettered by the traditional ways of thinking which are the heritage of the philosopher.

(2) *Difference in standpoints.* Psychology is interested in the individual mind—your mind and mine, whereas philosophy is interested in a universal mind—an ultimate principle behind your mind and mine. Naturally these two view-points point at two different directions. Psychology is becoming more and more objective in nature; it is interested more in manifest human behaviour than in the consciousness behind it. But the study of human consciousness and the subtle changes and modifications that it undergoes as it comes into contact with external influences is an integral and important part of all philosophic speculation.

(3) *Difference in starting points.* The starting point of psychology is the same as that of all other sciences—the world as one finds it. Its attitude to the external world, like that of the man in the street, is one of naïve realism. But the unreality of the world as one sees it, is one of the famous and well-established dogmas of philosophy.

4. Some Definitions of Psychology

(1) *The science of the soul.* This is the oldest definition of psychology, but does not deserve the respect due to its age. The soul is a very unsatisfactory term to use, as it has a distinct religious flavour. The psychologist is not opposed to religion, but he is averse to importing into his young science terminology that has taken root in a different sphere. Besides the meaning of the word "soul" is vague: it is difficult to say where the soul exists or what it exactly is.

(2) *The science of the mind.* The expression "mind" is a distinct improvement on "soul", as it has no theological associations. Yet the definition is unsatisfactory as it suggests a mechanistic view of the nature of psychology. There is no such object called the mind; there is only the brain. The mind is not a thing but a function. Psychology studies activities and not things.

(3) *The science of mental life.* This is a more satisfactory

definition than the previous one, for the phrase "mental life" brings out the ideas of activity and behaviour which are essential to the psychological point of view. The only criticism that can be brought against it is that it is too concise. Some indication should be given of the nature of mental life.

(4) *The science of consciousness.* Psychology deals with all aspects of man's conscious life, i.e. all that a normal human being is aware of as happening to him. The objection to this definition is that it is not wide enough. It does not include the unconscious elements of our life, our fleeting dreams and those hidden motives behind our behaviour which the psychoanalyst emphasizes.

(5) *The science of the conscious and the near-conscious activities of the human individual.* This definition by Woodworth is one of the most satisfactory that we have got. It takes into account all aspects of mental life. The only objection that can be raised against it is that it leaves out of account the whole field of animal psychology and also our social activities.

(6) *The science of behaviour.* The neglect of animal psychology noted in the previous definition is here rectified. For though it is a moot point whether animals are conscious or not, there can be no doubt that they do behave. This definition naturally comes from the animal psychologist and also from a school of psychologists known as behaviourists. The behaviourist is anxious to make psychology scientific and purely objective in nature and on this account is of the opinion that consciousness which is purely private should not form part of its subject matter. J. B. Watson, the founder of the behaviourist school, describes the task of psychology thus:

> "A psychology of interest to all scientific men will take as its starting point just the observable fact that organisms man and animal alike, do adjust themselves to their environment. These adjustments may be very adequate or they may be so inadequate that the organism barely maintains its existence. Secondly, certain stimuli lead the organisms to make the responses. In a system of psychology completely worked out, given the response, the stimuli can be predicted, given the stimuli, the response can be predicted."

5. Other Views

Opposed to the extreme objective standpoint of J. B. Watson is that of George T. Ladd who defines psychology as the "systematic description and explanation of the phenomenon of consciousness as such".

According to McDougall, the aim of psychology is to render the knowledge of human nature more exact and systematic, in order that we may control ourselves more wisely and influence our fellow-men more effectively. Psychology, he adds, is clearly concerned with human nature in its mental aspect. It is the positive and empirical science of the human mind.

Knight Dunlap draws our attention to an interesting misuse of the term "psychological" in current popular literature. It is often used in the sense of designating "a delicacy or a certain niceness of discrimination or adjustment. Thus the 'psychological moment' implies the instant of time so appropriate for a certain act that a moment before or a moment after would be too late. Any very precise analytic description of the characteristics of human beings or even a simulation of precision is called 'psychological', hence we find psychological novels and so forth. Now while psychology modestly acknowledges this pretension to exactness of analysis she must deny exclusive claim thereto, and cannot even pose as the only science which analyses human activity and experience".

Modern psychology, says Titchner, "is an attempt to bring the methods of scientific investigation which have proved so successful in other fields, to bear upon mental life and its problems. Mental life is revealed in human activities and psychology is therefore a scientific study of the activities of the individual". Anything that occurs in a human individual after his life has ceased is not an activity, but any process which depends on life is an activity. So not only bodily activities like speaking and running but also learning and feeling happy and sad are activities. Psychology tries to find out how individuals differ from each other in their activities and also how they act alike. It tries also to find general laws underlying human activities like learning, thinking, feeling, moving, etc. Psychology is not interested either in dead bodies or disembodied spirits but in living and acting individuals.

CHAPTER III

BRANCHES AND METHODS

1. General Psychology

This is the psychology taught in schools and colleges, the psychology referred to in ordinary talk. It deals with the groundwork of the principles of our science. It makes use of the discoveries made by different branches of psychology, uses all methods and has no special allegiances. It makes use of all the valid conclusions arrived at by all the workers in the field irrespective of the particular school they may belong to. For example, in general psychology we make use of the discoveries made by the child psychologist as well as the animal psychologist and take into account the principles of learning put forward by the Gestalt school as well as the school of behaviourism. General psychology is concerned with the mental life of the normal human being.

2. Comparative Psychology

Comparison is one of the chief methods of science and has been used with great success in philology and anatomy. A good deal of light can be thrown on the working of the human mind by comparing the behaviour of children with that of animals on the one hand and grown-up people on the other and noting differences as well as correspondences. The behaviour of adult civilized people can be compared with those of the primitives. A comparison can also be made of the myths, beliefs and national stories of different races in different stages of culture and progress. The following are the main branches of comparative psychology:

(*a*) *Child psychology* consists of the study of the mental life of children from birth up to about eleven years. A child is not merely a bundle of disconnected activities but has a personality of its own. The development of this personality is capable of systematic observation. The genetic method is par-

ticularly useful in child psychology, as many of the behaviour patterns of the adult can be found in a simpler form in children. This is especially true of the process of learning. Charlotte Bühler sums up the scope of child psychology thus:

> "The development of modern child psychology in the last ten to twenty years, through its systematic study of the child in all its life situations, enables us today, not only to present a very complete scientific picture of mental development, but also to solve many practical problems which children present. . . . The study of the development of the normal average child has given us a standard of comparison and a basis of understanding the mentally ill, the delinquent, the retarded and the problem child."

(*b*) *Animal psychology*. The theory of evolution has completely changed our attitude towards the animal. If we are related to the animal, then we may successfully apply the genetic method to the study of animal behaviour and trace therein the rudiments of complicated human activity. Like other branches of comparative psychology the study of animal behaviour has thrown much light on the nature of instincts and the process of learning.

It was the American psychologist Thorndike who inaugurated a new era in psychology by his systematic experiments on animals. At the very beginning of the present century many new workers took up research in this field. Thorndike in his puzzle box had given to animal psychologists a very useful bit of apparatus for the study of animal learning. In 1900 Small introduced another, the maze. Another persevering worker, Yerkes, started with elementary forms of life and steadily worked his way up through mice, frogs, turtles, crows, pigs and monkeys. As a result of the patient and painstaking work of Yerkes and his followers the field of animal psychology has been considerably widened, and its methods refined. The German psychologist Köhler was interned on the island of Teneriffe, off the coast of Africa during the First World War and spent his enforced confinement experimenting on the anthropoid apes which the Prussian Academy of Science kept here. He tackled such processes as perception, discrimination, learning and modification of responses. The Russian neurologist

Pavlov discovered the conditioned reflex by working on his laboratory dogs. Margaret Washburn, in 1908, wrote the first text-book on animal psychology and thereby definitely established it as a regular part of our science.

(*c*) *Primitive psychology*. The study of the beliefs, customs and institutions of primitive people is a fascinating and profitable one and anthropologists and psychologists have laboured long in this field. Many of our social customs and superstitions which appear to be meaningless at present have their origin in primitive times when they were matters of great importance. The study of primitive psychology has thrown much light on the evolution of religion. Tylor is a pioneer in this field. In his book *Primitive Culture*, he tries to show that religion has been evolved out of certain attributes of primitive mentality. He put forward the theory of animism which may be looked upon as the first form that the infant religious spirit takes. Animism is the doctrine that attributes a living soul not only to human beings but also to the lower animals, to inanimate objects and natural phenomena in general.

In 1900, Wundt, the German psychologist, published the first volume of his *Folk Psychology*. This book did much to bring modern psychology into relation with anthropology, a connection which it has since then kept up to the advantage of both. Ten years before, in 1890, Sir James Frazer had published the first edition of his great work *The Golden Bough*. It eventually ran into more than ten volumes and was a veritable storehouse of knowledge, giving a varied and exhaustive account of the manners, customs and institutions of many primitive people. In 1912 Freud began a series of articles which was later published in book form (*Totem and Taboo*). This is an interesting attempt to apply psycho-analytic principles to the study of the primitive mind.

3. Abnormal Psychology

Abnormal psychology concerns itself with the study of mental and nervous disorders. This was, for a long time, a special field of research of the French psychologists. They had produced many distinguished investigators in the field, like Charcot and Janet. Charcot studied functional nervous

disorders, i.e. nervous disorders where there is no actual bodily ailment present but where something has gone wrong with the working of the nervous system, e.g. hysteria. He came to the conclusion that in all such cases the root of the trouble was psychological. Janet continued this line of research and used hypnotism in the investigation of such cases.

By studying the abnormal mind, psychologists have not only been able to understand the normal human mind better, but in many cases they have been able to devise cures for these abnormalities. After the first World War many soldiers returned home with some kind of nervous trouble. Some were suffering from strange and unaccountable fears (phobias). For example, some people found it impossible to sleep within a room or stay for any length of time within an enclosed space (claustrophobia). Others complained of inability to see or use their hands or legs, but the doctors after examining them thoroughly assured them that there was nothing wrong with these organs. Such people came to the psychologist for help and in many cases he was able to bring about cures.

Another fruitful line of investigation undertaken by these psychologists is the study of the criminal. Largely due to their efforts the public are slowly coming to realize that a man takes to crime not out of choice, but because society has neglected to look after him properly or because there is something wrong with his mind. Some people, though really wealthy, steal things from the houses of their friends. They do so because they cannot help doing so (kleptomania) and it is useless to blame them for their actions. Many criminals, though not actually mad, are feeble-minded or men of very low intelligence. Especially is this the case with the delinquent or the young criminal who indulges in a series of petty thefts or runs away from school or home. Cyril Burt of the University of London has made an exhaustive study of the mental life of the delinquent and many others in America have been working along the same lines.

Abnormal psychology may be sub-divided into the following three branches:

(*a*) *Mental hygiene.* Hygiene deals with the prevention of disease and the preservation of health. Mental hygiene bears

the same relation to psychotherapy as hygiene does to medicine. It is the science that deals with the preservation of mental health and the prevention of mental disorders. It tells us not only how to avoid such behaviour as may result in mental illness, but also puts before us a positive ideal, i.e. a healthy mind. Our mind can be healthy only when all our innate tendencies find full expression in harmony with one another.

(*b*) *Psychotherapy*. If the principles of mental hygiene fail us and we fall a victim to some kind of mental disorder, then we have to consult a psychotherapist. Psychotherapy is concerned with the treatment and curing of mental and nervous disorders. A psychotherapist does not use medicine but some psychological method of healing. There are many such methods: hypnotism, suggestion, auto-suggestion, and perhaps the most well known of all, psycho-analysis.

(*c*) *Psychopathology*. Pathology is a systematic investigation of the various diseases that may attack the human body. Psychopathology is related to psychotherapy in exactly the same way that pathology is related to medicine. It is a systematic study of the mental and nervous disorders that a human being is subject to. Before we can attempt to cure mental illnesses we must first of all know how many different types of such illnesses there are and their symptoms.

4. Physiological Psychology

This deals with the brain, the nervous system, sensations and the structure of the sense-organs. Though we cannot locate the mind in any particular part of the body, yet it is intimately connected with the brain and the nervous system. Hence the need for a detailed study of these two parts of our body.

Mental life is generally divided into three aspects—cognition or the awareness of the external world, conation (or volition) or the will and affection or the emotions. The cognitive process or the way in which we are made aware of the external world is through the sensations, and sensations reach us through the sense organs. Every student of psychology should have a clear understanding of the structure and func-

tions of the various sense-organs. The mind and body act and react on each other and everyone who aspires to understand mental life in all its complexity should have at least a working knowledge of such of the bodily functions as are directly connected with the mind.

5. Social Psychology

We have already noted that social psychology studies the behaviour of the individual in so far as that affects the group of which he is a member or is affected by such a group. "That man was not born to live alone" says Cooley "is an old observation of more significance than is usually attributed it in suggesting matrimony to likely bachelors or to marriageable women. . . . A separate individual is an abstraction unknown to experience, and so likewise is society when regarded as something apart from individuals. The real thing is human life, which may be considered either in an individual aspect or in a social, that is to say general. In other words 'society' and 'individuals' do not denote separate phenomena, but are simply collective and distributive aspects of the same thing." Social psychology studies the individual with special reference to such of his instincts and tendencies as make him a gregarious animal.

The study of social psychology as a separate science began rather suddenly in the beginning of the present century. It began with interest in folk psychology or the life of primitive people. In 1895 Le Bon in his book *The Crowd* drew attention to the fact that a group of people considered as a unit has a psychological dimension of its own and may possess characteristics which none of the individuals forming that group possess. Conversely a change seems to come over an individual when he is part of a group. He falls in line with the rest of the group and seems to lose his powers of independent judgment. In 1908 McDougall published his epoch making work *An Introduction to Social Psychology*, which instantaneously became popular and, as Flugel points out, has gone through more editions than any other book on psychology. Today social psychologists are tackling many interesting problems. In America a thorough study has been made of

the race problem with special reference to the Negro and similar studies are being undertaken in other parts of the world.

6. Educational Psychology

Educational psychology seeks to apply psychological discoveries to the technique of teaching, as well as to the problems of children. Psychological analysis of the processes of learning and attention have been of immense help to educationalists. Discoveries as to the nature of instincts, have also helped teachers to strike the right note at the right age, when dealing with children. Above all the improvements in the methods of measuring intelligence have been a boon to all those concerned with the education of the young. "Further," says Flugel, "there has been a good deal of valuable experimental work on the best methods of learning and teaching different subjects. . . . Experimental studies of reading in which the eye movements of the reader were recorded photographically have, for instance, shown that in learning to read it is advantageous in many ways to use from the start larger units consisting of words and sentences rather than the elementary units corresponding to letters of the alphabet. Similarly, in writing it has been possible to arrange a series of exercises which develop proper habits of fluent movement from the very beginning. In these and other ways psychology has been making invaluable contributions to the detailed routine of the classroom."

7. Industrial Psychology

The study of the process of attention by the psychologist has thrown a good deal of light on the various ways of catching and holding people's attention. This has resulted in considerable improvements in the methods of advertising (one of the most important aspects of industry in this age of mass production). Another helpful line of investigation is the study of fatigue. Fatigue is one of the biggest stumbling blocks to increased production. Psychological studies have centred round problems like how to eliminate unnecessary movements in doing a particular task, how to keep employees happy and contented, how to make use of the spirit of competition among

workers to increase output, the effect of short intervals for rest and recreation on total production, etc.

8. Vocational Guidance

The task of this branch of psychology is twofold, to analyse the various requirements for success in a particular job and to examine people by means of various tests and find out whether they are fit for a particular job. The aim of vocational guidance is to eliminate occupational misfits. Psychological research helps us to understand in detail the nature of human abilities and temperament. Individual differences in them can now be measured more accurately than before. There is also a fairly good battery of tests for measuring traits essential for success in various kinds of work.

Methods of Psychology

1. *Introspection.*

Introspection is a looking within. It is self-observation—observation by an individual of his own mental states, directly and by the use of his memory. After performing a task, the subject looks back and tries to remember what exactly passed through his mind while he was doing that task. By means of careful and systematic introspective study we may gain many useful facts regarding our conscious life.

Stout mentions three stages in the development of the introspective process:

(i) *The transition from the objective to the subjective point of view.* Here a man who was previously engaged in watching something else now begins to notice that *he* is watching it. Instead of being engrossed in the contemplation of an object, he now begins to realize that his mind is watching an object. His attention is now divided between the observation of an object and the observation of his own mental states, as they watch the object. His self-consciousness is slowly awakening, he is in the "rudimentary stage of explicit self-consciousness".

(ii) *The reflective stage.* Here the subject besides observing his own mental states begins to ask questions regarding their nature and validity. His interest in the working of his mind is awakened and he asks himself questions like "Am I really

watching that object or dreaming?" "Is my mind really convinced about this problem?" "What put this idea first into my mind?" and so on.

(iii) *The scientific stage.* Here the subject uses introspection as a scientific method. By observing his mind he tries to deduce general laws regarding its nature. He asks himself questions like "Can I pay attention to two things at a time?" "Can I be in a mixed state of pleasure and pain?" and so on.

Defects of the Introspective Method

Many of the vital and interesting experiences of human nature cannot be reproduced at will so that we may make introspective studies of them at leisure, and while they last they are so all absorbing that we have no time for introspection. For example, we cannot now reproduce the feelings that we had on the occasion of the death of a friend or relative because the stimulus is now lacking. At the actual time of occurrence we were naturally too consumed by grief to think of anything else.

The introspective habit being to a certain extent unnatural cannot be easily learnt. It requires considerable patience and practice to become a skilful introspectionist. The natural tendency of the human mind is to go forward from one task to another and not to turn back. The introspectionist has to therefore deliberately cultivate this habit of turning back his mind. Indeed so difficult is this task that a good many people find it absolutely impossible to introspect at all with any degree of success. The difficulty is further heightened by the fact that it is all too easy to mix up explanations and comments with the actually observed mental processes.

In introspection our attention is divided between the observation of our mind and the observation of the object on which the mind is being focused. Division of attention always leads to inaccuracy of observation. The continuous oscillation of attention in introspection is undoubtedly a strain and many people are incapable of bearing it. Here again accuracy and skill increases with training and practice.

Often language difficulties arise in the exchange of introspective experiences. The finer shades of feeling and emotion are far too tricky and transitory to be caught in the meshes of

a stable vocabulary. We often find that language is hopelessly inadequate to express the depth and intensity of our emotions. Besides, often two people may use the same word to denote two vastly different grades of emotion. Two people may exclaim "Beautiful!" on seeing "a primrose by the river's bank", and yet to the one it may just be a primrose while the other sees in it the very face of God.

Lastly, introspection, it is claimed, being purely subjective in nature has no place in a system of psychology which seeks to make its data as objective as possible. This is by far the weightiest of objections that has been brought forward against introspection as a psychological method. As we have just now seen, introspection is an account of the internal states of consciousness, and as this is something that other people cannot get at, its value as scientific material has been seriously questioned. The behaviourists under the leadership of J. B. Watson of America have definitely revolted against the very idea of using introspection in psychology. They claim that it is the business of a science to weigh and measure facts and therefore a purely subjective phenomenon has no place in the science of psychology.

When you are introspecting something is going on in your mind. This something is locked up in the privacy of your consciousness. It is not accessible to anybody else. There is no means by which anybody can check up the validity of introspective data. The subject who is introspecting may unconsciously twist facts or he may even deliberately tell lies and there is nothing to prevent him from doing so. In introspection one is at the mercy of his subject and no scientist likes this.

One can very well understand the impatience of certain psychologists with introspection. In their eagerness to make psychology a science they are anxious summarily to brush aside all barriers in the way. Yet psychology is a young science and as such cannot afford to neglect any important source of knowledge. Introspection does provide us with valuable information regarding the working of the mind. There is no reason why we should not make use of these facts provided we exercise due caution. As far as possible, introspective evidence should

be confirmed by objective observation. "We should not expect too much from it." It should come from reliable men who have acquired considerable skill in the technique of introspection.

It is for these reasons that the existentialists[1] under the leadership of Müller and Titchner have advocated a limited use of introspection as a supplement to experiment in psychology. They point out that sciences of such repute as physics and physiology have used this method. By the use of the combined method of experiment and introspection many valuable discoveries have been made in psychology, as, for example, Binet's discovery of imageless thinking and the nature of the memorizing process by Müller. The existentialists claim that consciousness is a basic fact of mental life and that it would be suicidal to neglect it. The only way to get at consciousness is by means of careful and controlled introspection.

2. Objective Observation

The revolt against introspection has taken the form of greater emphasis on objective observation as a method of psychology. In objective observation the attention is focused not on the self and its conscious states but on the gestures, behaviour and social adaptations and bodily changes of other people. We may either observe the behaviour of different people under different circumstances or confront different people with the same kind of situation and see how each man differs in his reactions. Thus, whereas in old-fashioned introspection, the emphasis was on the self, in objective observation it is transferred to "the other one"—the object or person studied. The growth of the objective method of study, in psychology, has coincided with the growth of the movement to make psychology scientific, for in many other sciences this is the only method used.

Objective observation has been used with a good deal of success both in animal and child psychology. In animal psychology by the very nature of the case, introspection cannot be used. Children, no doubt, can give us some kind of intro-

[1]The Existential School of Psychology is not in anyway connected with the recent Philosophy of Existentialism developed by Sartre and others.

spection, but it is neither coherent nor reliable. Under these circumstances the psychologist working in either of these fields has been forced to confine his researches to the accurate and minute observation of the behaviour of his subjects. Children have been put under glass cases, from which, though they were visible to the observer, the observer himself was not visible to them and detailed records have been made of their activities during stated periods of time. The behaviour of animals like cats and white mice, in mazes and puzzle boxes, have also been studied carefully and accurately. Such objective methods of study when applied to children and animals have led to many discoveries of first-rate importance to psychology, like the discovery of the conditioned reflex by Pavlov and the nature of trial and error learning by Thorndike.

Another fruitful source of study in the sphere of objective observation is the bodily changes that occur in us during intense emotional states like fear, anger and rage. W. B. Cannon has made an extensive study of such phenomena. We now know that intense emotional states have definite effects on the digestive, circulatory and respiratory systems. Besides this, certain glands in the body known as the endocrine glands become active during these states. The use of many delicate instruments has made it possible to measure accurately some of these changes. Among such instruments mention can be made of the galvanometer which records the "psychogalvanic" reflex or the variations in the amount of electrical energy that passes over the surface of the skin and the pneumograph and the plethysmograph which record changes in breathing and variation in size of finger, hand or other bodily members due to the fluctuation in the blood supply, respectively.

3. Experiment

The essence of an experiment consists in controlling the conditions under which a phenomenon occurs, then varying these conditions systematically and noting the results. "In an experiment we are not content to take facts as we find them. We interfere with them and arrange them for ourselves in order to see what will happen. An experiment is thus a question asked of nature."

We must make a distinction, however, between a test and an experiment. In an experiment we take a few people into the laboratory and there wilfully change the conditions under which they work. In a test we go out into the world and there examine a large number of people under a fixed condition. The advantages of experiment as a method of scientific procedure are these: (1) The facts come to you. (2) Being under control these facts are capable of verification. (3) The results that we get are precise and capable of quantitative treatment (statistical analysis). "One of the drawbacks of psychology's long association with philosophy was this, that psychology was tending to be largely speculative and theoretical in nature. The discovery of a few facts about the mind as a result of experiments performed under rigidly controlled conditions has done much to counteract this tendency."

Under these circumstances it is no wonder that those who have sought to make psychology scientific have emphasized the great need for experimental work. It was in 1879 that Wundt established the first psychological laboratory in Leipzig, in Germany. Since then the importance of experiment in psychology has been steadily growing.

Besides the requisite apparatus, two persons are necessary for a psychological experiment: (1) The subject, on whom the experiment is being performed and (2) the experimenter, who varies the conditions and notes their effect on the subject. As a good example of a modern psychological experiment may be mentioned the attempt to study the effects of distraction on a person's capacity for work. The subject is put in a soundproof room and is given a simple task to perform like tapping or putting dots on squared paper. At first he is allowed to work without any distraction and the rate of his progress is noted. Then distractions like the beating of a drum, pinpricks on the body, are introduced at fixed intervals and any alterations in the speed of his work observed. A comparison of these results thus supplies us with a quantitative or statistical means of determining the effects of distraction on the work capacity of an individual.

It is necessary to retain introspection in psychological experiments because certain phenomena though objective in

nature cannot be studied except by an appeal to the subject's consciousness, for example, the after-image. Experiments when used in psychology become far more complicated and difficult than those used in any other science because, though external conditions may be controlled, the mind of the subject which is essentially part of the experimental situation, is not easily manageable. The moods of the subject, for example, are beyond the reach of the experimenter and yet they may influence a good deal the way in which the subject performs the experiment.

4. Genetic Method

This method goes back to the origin of the phenomena being studied and traces their gradual development and unfolding of characteristics. The use of this method has resulted in greater interest being taken in the mental life of children, animals and primitive people. Those psychologists who aim at curing certain mental and nervous diseases, like the psychoanalysts, also use this method a good deal. For they hold that many mental disorders of the adult are due to certain unpleasant incidents that happened to him in childhood. By the use of the genetic method they try to find out details about these infantile experiences.

The genetic method seeks to find the causes of complicated phenomena in simple beginnings. Thus a study of the instinctive life of animals and children throws much light on the nature of the complicated behaviour patterns of the adult. Similarly, we are able to understand better the meaning of certain institutions and ideas that we find in civilized society by tracing back their origin to primitive times and studying them in simpler forms. Some psychologists, whom we may call field psychologists, have actually gone and lived with such primitive people as we find in the world today, with a view of observing their manners and customs. Their researches have thrown much light on the nature and origin of many complicated institutions that we find in society today.

5. Case-history Method

This is a form of the genetic method. It is essentially a clinical method (a method used by doctors). One of the first

things that a doctor does when a patient goes to consult him is to put down on paper all those incidents in the past life of the patient which, he thinks, have some connection with his illness. Now that psychologists are also trying to cure certain types of mental diseases, it is only natural that they should also compile similar case-histories. When a mental sufferer goes to a psychologist he first of all questions him (the interview) and tries to find out whether there have been any incidents in the past, especially during childhood, which may be the cause of his present trouble. He also questions his parents and friends, reads his correspondence if any is available, and goes into all those matters which in any way throw light on the past life and conduct of his patient.

The interview is becoming popular among psychologists as a means of gathering data about certain aspects of people's past and their attitude to certain problems with which they are brought face to face from time to time. The interview is what we may call the direct method of gathering information—for the subject sits opposite to you and you usually ask him certain leading questions. Though widely used and in many cases with a good deal of success, we must not be blind to the dangers of this method of gathering data. Considerations of politeness may prevent the subject from being as frank and straightforward as you want him to be. Considerations of delicacy or bashfulness may prevent him from being entirely truthful when answering questions of a personal nature, like sex. Assurances of secrecy, the use of a screen between the interviewer and the interviewee (to eliminate the personal element) and giving the questions typed out on cards instead of asking them orally, all help to make the data gathered by the interview increasingly reliable.

6. Statistical Method

Of late this method is being increasingly used in psychology. It is highly technical and quantitative in nature, as opposed to other methods of psychology, which are qualitative or descriptive. In a quantitative method we reduce qualities to numbers by some system of marking and then submit these marks to mathematical analysis. A classic example of the use

of this method in psychology is to be found in the work of Spearman, in the field of intelligence. The method has also been used a good deal in the study of social problems. Questions like, "Is a given group conservative or liberal?" "Has it colour prejudice or not?" can be treated quantitatively by devising a questionnaire which is given to all the people in the group. The marks obtained by each will give us some idea of the intensity of their views. An average of the marks will express in a convenient way the general tendency of the group on these matters.

7. Field Survey Method

This includes both field investigation and field observation In the former we investigate social conditions, political attitudes, hereditary factors, etc., of a group of people. This is the method of anthropology. In the latter we observe animal behaviour under natural conditions. In one sense, field psychology is the opposite of experimental psychology. In an experiment we observe behaviour under artificial conditions; in a field study we go out and observe phenomena under natural surroundings. This method has been used a good deal by social and animal psychologists.

CHAPTER IV

THE STORY OF THE NERVOUS SYSTEM

1. Stimulus—Reaction

Psychology studies mental life and one of the ways in which this is revealed to us is through bodily activity. Behaviour is another name that we give to such activity. "By behaviour" says McDougall "we commonly mean the action or actions of some living thing. It is true that we may say of a ship or an automobile that she is behaving badly today. But in such cases we are personifying the ship or the automobile; thinking of it as a living person. Behaviour then is peculiar to living persons. When an animal is dead its corpse does not behave. It becomes inert, the sport of forces that play upon it, from without. A certain spontaneity of movement is essential for behaviour. In behaving an animal is not simply pushed or pulled by forces external to itself, but it actively resists the push or pull."

All activity or behaviour can be fitted into the stimulus-response scheme. "A stimulus, literally a goad or a pointed stick, is anything that arouses the organism or any of its parts to activity. Light is a stimulus for the eye and sound to the ear. A response is any activity that is awakened or aroused by a stimulus." To take a few simple examples, somebody pricks you with a pin and you lift up your arm. Here the stimulus is the pin-prick, the response is the lifting of the arm. You hear the college bell and begin to run—the college bell is the stimulus, your response is the running. In short anything that arouses activity in a man or animal is a stimulus and the resulting activity is the response. A stimulus need not necessarily be an external one. When you feel hungry and eat, the stimulus hunger is an internal one. Also responses need not necessarily take the form of outward behaviour. When you hear the college bell and instead of running, just think how pleasant it would be if the day was a holiday, then the response

is an internal one—a thought. All mental phenomena, whether movements, sensations, emotions, impulses or thoughts are a person's acts and every act is a response to some present stimulus.

2. Types of Responses

Responses are of three types:

(*a*) Reflexes.
(*b*) Reactions.
(*c*) Secondary automatic reactions.

(*a*) *Reflexes*—are very simple types of reactions. We are born with them and need not have to learn them. Actions like sneezing, when something irritates the nose or the watering of the eye, when a foreign body enters it are all reflexes. Another example is the instinctive jerking of the leg when somebody tickles the sole of your foot (flexion reflex). The reflex is therefore something native and inherent in the organism. It is permanent. The reflex-connection between stimulus and response is something that a child brings into this world.

(*b*) *Reactions*—a reaction is a response to a stimulus. As we have already seen a reflex is one kind of reaction. But when we speak of reactions we mean responses that are learnt as opposed to responses that are natural, the reflexes. Almost anything that an educated adult has learnt to do is a reaction. Reactions therefore can be very complicated. For example, the very lengthy college education that a student undergoes is a reaction to the stimulus, the desire for a university degree. But we shall consider here only the simplest type of reaction or the "simple reaction" as it is called. Saying "Here sir" when a student's name is called on the roll is an example. It is not a reflex because the student had to learn to say it. A child has to be taught to make the correct reactions to the various types of stimuli that he comes across at home and outside and a good deal of its education is merely the process of learning to make the appropriate reactions as occasions demand them.

(*c*) *Secondary automatic reactions*—certain simple reactions through constant usage become mechanical. Whereas a reaction is always conscious, the result of a certain amount of thinking,

secondary automatic reactions, as the name itself suggests, are almost unconscious. Every time we put on our coats we do not say to ourselves that we have to button them up. The thing comes to us naturally without our giving any thought to it. And yet it is not a reflex. In the beginning we have to learn to do it. Most habits are cases of secondary automatic reactions.

Comparing the reflex with the simple reaction we note the following differences between the two:

(1) The reflex is much more deep-seated in the organism, more essential to its welfare than the simple reaction. Reactions can be learnt and forgotten and some reactions may be harmful to the organism, as that of putting a cigarette into your mouth and lighting it whenever you see one. But a reflex can never be forgotten and it is always beneficial.

(2) The reflex is typically quicker than the quickest of simple reactions. The quickest simple reaction takes about ·15 seconds whereas many reflexes take only ·05 seconds.

(3) The reflex machinery is always ready for business, it does not need a preparatory signal. But many reactions need such a preparatory signal. The runner before he responds to the starting pistol-fire is given a ready signal, but no such signal is necessary for you to kick up your leg when somebody tickles your sole.

(4) Since reactions are learnt any kind of response may get attached to any kind of stimulus. Besides, the same stimulus may evoke two different kinds of response from two different people. You are watching a football match with your friend. He supports the opposite side to yours. Under these circumstances the same stimulus, a goal scored, will evoke in you and your friend quite different reactions. The connection between stimulus and response in a reaction is arbitrary, it follows no fixed rules. It is also temporary, since you can learn to make a different response to the same stimulus. But in reflex action the connection between stimulus and response is fixed and permanent.

(5) Reflex action is involuntary, we have no control over it. Ordinarily we are powerless to stop it, as anyone who has been seized with a fit of sneezing at an awkward moment can find for himself. Reactions on the other hand are capable of

control to a much greater degree. It follows from this that reflex action is mostly unconscious whereas the reaction is not.

Next comparing the reflex with the secondary automatic reaction we note the following differences between them:

(1) A secondary automatic reaction rarely reaches the speed of the quickest reflex, at best it may have the speed of the simple reaction.

(2) Though often serving a useful purpose it is not so essential to the welfare of the organism as the reflex is. We have seen that most habits can be classed as secondary automatic reactions and since there can be good habits as well as bad, it follows that some secondary automatic reactions are even harmful to the organism.

3. The Nervous System

The stimulus happens in one part of the body and the response in another. What is the means of communication between the two? You are pricked, in the palm of your hand by a pin and you lift up your arm. How are you made aware that you have been pricked by a pin? And, what makes you lift up your arm? The answer to both these questions is to be found in the nervous system. The nerves are the messenger boys of our body, the means of communication between its different parts.

Let us see what happens in the case of the pin-prick. From the palm of the hand a sensory nerve conveys the information that you have been pricked to a nerve centre and from the nerve centre a motor nerve sends an impulse to the muscles of the arm and immediately you lift up your arm. The nerve connections in this simple form of activity are known as a reflex arc and consist of a sensory nerve, a nerve centre and a motor nerve. (Bundles of motor nerves run from different parts of the body into the brain and spinal cord and bundles of sensory nerves run out from the brain and the spinal cord into different parts of the body. The nerve centres are all located either in the brain or in the spinal cord.)

The nervous system can be compared to a city telephone system with the difference that the call gets through much more quickly than it ever does in a telephone system. It is

one of the many systems of the body, the others being the digestive, the respiratory and the circulatory. A system leads to consolidation, co-ordination and economy of energy. In a system every part is connected with every other part by means of a central agency. And the central agency is therefore able to connect up any two required parts. A system is the quickest way of connecting up different units and in it there is the least possible waste of energy.

4. Structure of Nerves

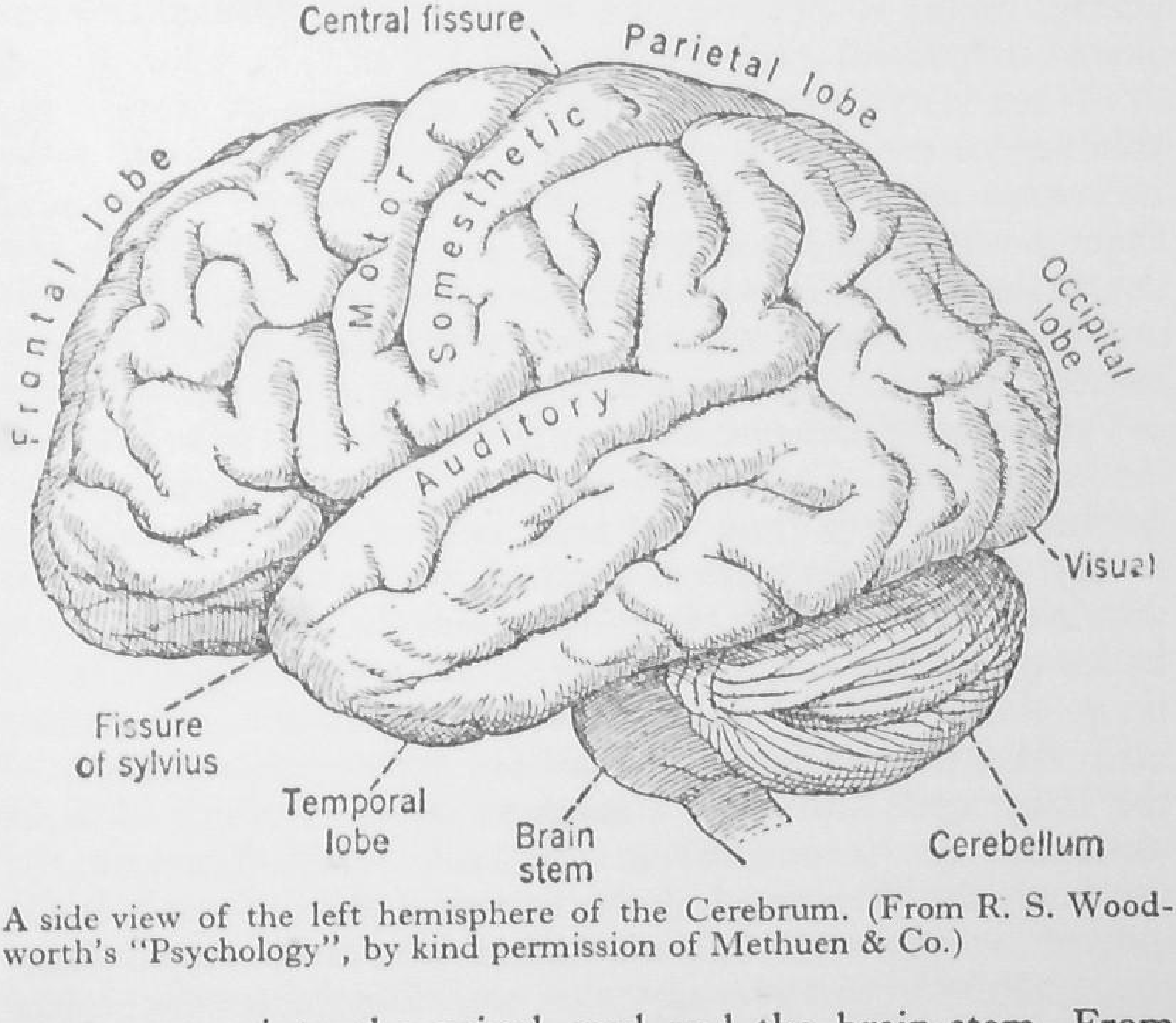
If you cut a telephone wire you will find that what you took to be a single wire is really made up of a number of very thin wires bundled together and enclosed in some kind of protective wrapping. Similarly, a nerve is really a bundle of fibres surrounded by a sheath of connective tissue known as the perineurium. These fibres are known as the *neurones*. The whole nervous system is therefore essentially composed of neurones. A neurone is made up of: (1) the *nerve cell*; (2) the *axon*; (3) the *dendrite* and (4) the *end-brush*. The axon is the long thread-like substance issuing from the nerve cell. It terminates in a mass of tree-like branches, the end-brush. From the other end of the nerve cell there proceeds another mass of short branches, the dendrite.

What passes along the nerves is some kind of energy, probably electrical in nature. How does this energy pass from one neurone to another? A neurone always ends in an end-brush and one end-brush is in close proximity to another dendrite. This junction between an end-brush and a dendrite is known as a *synapse*. Nerve energy passes from one neurone to another at the synapse. At a synapse there is no actual contact between an end-brush and a dendrite. They are in close proximity without actually touching each other and the nerve energy when it reaches an end-brush jumps on to the next dendrite. Communication at a synapse is always in one direction—from end-brush to dendrite. The nerve current initiated at a nerve cell passes along an axon, reaches an end-brush and from thence goes across to a dendrite. A single axon may break up into several branches and end in several end-brushes and since each of these end-brushes will be in

contact with a dendrite, the nerve energy from a single nerve cell may pass on to a number of different dendrites. In this way the neurones are all interlocked into a close system and nervous energy may take different routes as the occasions demand.

5. The Brain

We have left the most important part of the story of the nervous system till the end. The brain is the seat of consciousness, the controller of all nervous activity and the initiator of many an important nervous movement. But for a single exception (the eye), there is no direct connection between the brain and any part of the body. Bundles of nerves run from different



A side view of the left hemisphere of the Cerebrum. (From R. S. Woodworth's "Psychology", by kind permission of Methuen & Co.)

sense-organs into the spinal cord and the brain-stem. From these places another set of nerves run into the brain. Similarly, bundles of nerves run from the brain into the brain-stem

and the spinal cord and from these places sets of nerves run into our glands and muscles. So the brain controls all our activity, only indirectly, through the spinal cord and the brain-stem.

The brain is securely placed inside the skull. But supposing for the sake of our story, we are inhuman enough to crack a human skull open, we will see a white mass of soft substance with its external surface all crinkled up. This crinkly outer surface of the brain is known as the cortex. On the cortex we will find a number of deep lines which divide the brain into different areas. These lines are known as the fissures. The brain is divided into two hemispheres, the right and the left but their construction is identical. In each hemisphere two fissures can be noted—the fissure of Rolando or the central fissure at the top and the fissure of Sylvius towards the base. (*See* diagram on previous page.)

When we were referring to the brain so far we were really thinking of the cerebrum, which is the biggest and the most important part of the brain. The brain, however, consists of three parts—besides the cerebrum there is the cerebellum and the brain-stem. The fissures divide the cerebrum into lobes and in each lobe a sensory area is situated. Each of these sensory areas is connected with a particular sensation. Forward of the central fissure is the frontal lobe and in it is situated the motor area. All impulse for bodily activity coming from the brain proceeds from this area. In front of the motor area is the super motor area concerned with skilled movements requiring a high degree of nervous co-ordination. Immediately backward of the central fissure is the parietal lobe. In it, lying almost parallel to the motor area, is the somesthetic area. All skin and muscle sensations from different parts of the body reach this area. The visual area, to which all light sensations go, is situated in the back of the brain in the occipital lobe. Backward of the fissure of Sylvius towards the base of the cerebellum is the temporal lobe in which is situated the auditory area, which is the receiving centre for sound sensations.

One interesting phenomenon to be noted is that the left half of the brain is connected with the right side of the body

and the right half with the left. An injury to the motor area of the right half of the brain will therefore result in an impairment with motility on the left side of the body.

6. Higher and Lower Motor Centres

We have already noted that there is no direct connection between the brain and the various parts of the body. Nerve impulses from different parts of the body reach the brain through the spinal cord or the brain-stem and impulses coming from the brain to different parts of the body must also travel the same route. We must now further note that some impulses never reach the brain at all. The brain has nothing to do with reflex action. Human activity is the result of impulses coming from a motor centre, along motor nerves, to the muscles and glands. There are two such motor centres in the body: (1) the higher motor centres, situated in the motor area of the brain, and (2) the lower motor centres situated in the spinal cord and the brain-stem. Reflex action takes place entirely in the lower motor centres. The spinal cord contains the centres for the limbs and part of the trunk and the brain-stem, the centres for the head and part of the interior of the trunk (heart, lungs, etc.). So, when somebody tickles the sole of your foot and you kick up your leg the brain has nothing to do with it. Sensations from the sole of your foot are carried to the spinal cord by sensory nerves and from here an impulse to kick is sent to the leg muscles through motor nerves. A frog whose cerebral hemispheres have been removed still performs the typical jerking movement of the leg when a drop of acid is placed on it, thus demonstrating beyond all doubt that the brain has nothing to do with the matter.

Reflex action is unconscious action and is therefore disposed of by the lower motor centres in the spinal cord and the brain-stem. But whenever you are conscious of a sensation it means that the brain has come into action. When you hear the college bell and begin to run what exactly does happen in the nervous system? It is a conscious activity and therefore the brain enters into it. First of all the sound waves strike the ear, but from there do not go directly to the brain, for there is no such direct communication. Sensory nerves from the

ear carry the sound sensations to the brain-stem (for the brain-stem contains the lower motor centre for the head) and from here they are sent to the auditory area of the brain. It is only then that you are conscious of having heard the bell. From here a message is sent to the motor area. From the motor area an impulse to run is sent to the spinal cord (for the spinal cord contains the lower motor centre for the limbs) and from the cord motor nerves carry the impulse to the muscles of the leg and then you begin to run. The whole process is so very quick that you do not suspect that complicated activities lie behind it.

7. Facilitation and Inhibition

In describing reflex action we said that it is action purely on the lower level and that the brain has nothing to do with it. This is true as a rule, but the brain can interfere, even in reflex action if it wants to and it sometimes does do so. The two ways in which the cortex can interfere with the functioning of a reflex are known as *facilitation* and *inhibition*. Any influence that helps a response to occur and quickens its speed is said to facilitate it and any influence that hinders a response from occurring is said to inhibit it. The reflex act of quickly withdrawing your hand when it comes into contact with a hot object is inhibited by the brain when you find it absolutely necessary to grasp that object and carry it for sometime—for example, a glass tumbler. The speed of the winking movement of the eye can be increased, if we so desire it and this is a case of facilitation.

8. The Pyramidal Tract and the Thalamus

A large bundle of nerves known as the pyramidal tract runs from the motor area in the cortex to the lower motor centres and is the chief means of communication between the two. Conversely, sensations on their upward journey from the lower motor centres to the cortex are first sent to the thalamus. The thalamus is situated in the interior of the brain and forms a sort of clearing house where different sensations are sorted out and sent to the appropriate areas on the cortical surface. It has also something to do with our feelings and emotions.

9. The Cerebellum

So far we have said nothing about the third big division of the brain, the cerebellum. It has its own part to play in the direction of our activity. We now have enough evidence to say that it is concerned with the balance, poise and muscular co-ordination of our body.

CHAPTER V

SENSATION

1. The General Nature of Sensation

Man is popularly supposed to have five senses but recent physiological research has added three more to the list. In fiction and poetry we often come across reference to a vague sixth sense, which warns people of imminent danger and gives them an inkling of forthcoming events. This mysterious sense however, has not yet been located. The three new senses have definite sense-organs and specific functions.

The sense-organs have sometimes been described as the gateways of knowledge. This is a somewhat misleading metaphor. Knowledge does not enter into us ready made. Sensation is only the first step in that elaborate process that results in knowledge. A sensation has to be attended to, then a meaning attached to it and finally a general idea obtained by putting several meanings together. A sensation that is not attended to is lost to us for ever. The mind has an important share in transforming sensations into knowledge. Besides on certain occasions sense-organs, far from being gateways of knowledge, act as barriers of knowledge. Each sense-organ is constructed for the specific purpose of receiving one particular type of sensation. The ears cannot see nor the eyes hear. When a light stimulus falls on the ear, the sense-organ acts as a barrier and not as receiving centre. Even as regards a stimulus that a sense-organ is capable of receiving, it does so effectively only within a specific range. The portals of the ear are closed to very loud as well as very feeble sounds.

The question is sometimes asked—which is the most important of the senses? It is really impossible to arrange sensations in decreasing order of importance. Their importance varies in the case of different people, depending on their out-

look and interests in life.[1] Conventionally, the eye is supposed to be the most precious of all our sense-organs. A very valuable object is described as equivalent to the apple of the eye. The ear comes next. But the sensation that we can give up with the least amount of inconvenience is smell. Though valuable from an aesthetic point of view, we can forfeit it without the main tenor of our life being unduly disturbed. In fact, we do so temporarily every time we have a bad cold.

2. The Characteristics of Sensation

(1) A fundamental characteristic common to all sensations is a certain *change* that they bring about in us. We may call it *stimulation*. Angel calls it *shock*. Sensations make us aware of certain facts either in the outer world or within us. They generally take the form of some kind of motion in the physical world around us, e.g. air waves, ether waves, heat waves, etc.

(2) It is necessary that sensations to be effective must possess a certain amount of *intensity*. A very faint light, a mild odour or a scarcely audible sound may make no impression at all on us. They should, however, be not over-intense. We know from experience that when a sensation becomes too powerful, instead of stimulating us in the normal way it becomes merely painful, e.g. a very bright light, a shrill noise or intense cold.

(3) The point below which a sensation has no effect is called the *limen* or the lower limit and the point above which it becomes painful, the upper limit. Between these two limits, there are an almost indefinite number of sensory intensities.

(4) The upper and lower limits are also known as the *thresholds*. If a stimulus falls below the lower threshold it arouses no response at all. Such a powerless stimulus is known as a subliminal stimulus. Two or three subliminal stimuli may, however, join together and produce a single strong reaction. This phenomenon is known as the *summation of stimuli*. Roughly speaking it is a case of two negatives produc-

[1]A painter would rather forgo his sense of hearing than his sense of sight while the preference of a musician would be in the opposite direction. A gourmet may even give up both these to save the power of taste.

ing a positive. Or again two stimuli each of which when given separately is capable of producing only a weak response, may when given together produce a single strong response. A drop of acid, when put on a dog's back, produces only a weak scratch response. Another drop on a different part of the back may produce another weak response. But if two drops are applied simultaneously at a single spot there appears at once a strong scratch response.[1]

(5) Sensations have a *latency period*. This is the time taken by bodily tissues before they start making their normal responses. It takes a certain length of time (roughly about ·005 seconds to ·1 second) to arouse a sense-organ. Time is also taken in exciting the nerve fibres that lead to the brain. The brain connections, the motor nerves, the muscles also take time to act. Thus there is bound to be an interval between the awareness of the sensation and the consequent starting of action. Usually response follows stimulus so quickly that we think that they are simultaneous. But there is always this latent period which can be measured by means of a chronoscope.[2] Not only does it take time for nerves and tissues to start responding but they also stop responding gradually. There is thus a lag both ways. In the field of light this gives rise to the after-image.

(6) A stimulus to be effective must possess *duration*, i.e. it must act on the sense-organ concerned for a certain length of time. Duration alters the nature of the sensation. For example, if a colour sensation has a long duration, the eye gets fatigued and the colour becomes dim and fades away.

(7) Many sensations also possess *extensity*, i.e. we understand them as events extending over a certain length of time, in the case of sound sensations and occupying a certain amount of space, in the case of touch and visual sensations. Sensations act on a bigger or smaller area of the sense-organ. For example,

[1]Summation of stimuli is a familiar experience in our daily life. If you call a man a fool once he may perhaps overlook the matter. But if you call him so twice he is sure to retaliate.

[2]Special clock which can measure time up to a thousandth of a second.

the extensity of the sensations resulting from a hot bath is much greater than that resulting from a pin-prick.

3. The Mechanism of Sensation

For a sensation to happen stimuli from the external world must come into contact with a sense-organ. The result of this contact is the release of some kind of nervous energy which is carried by the sensory nerves to an appropriate region in the cortical area of the brain.[1] We are aware of having had a sensation only when all this has happened. Here is a list of sensations with their corresponding stimuli and sense-organs:

Sensation	*Stimulus*	*Sense-organ*
1. Tactual	Changes in the temperature or objects coming into contact with the skin	The skin
2. Gustatory	Chemical substances dissolved in saliva or other liquids	The tongue
3. Olfactory	Chemical substances in gaseous form	The nose
4. Organic	Churning of the walls of the stomach and certain chemical changes in the back of the throat	Stomach and the back of the throat
5. Kinesthetic	Pressure on the muscle-spindles and the tendons about the joints	Muscle spindles and certain tendons in the joints
6. Bodily equilibrium	Disturbances in the fluid of the semi-circular canals	Semi-circular canals
7. Auditory	Air vibrations	The ear
8. Visual	Ether vibrations	The eye

4. Cutaneous Sensations

The skin is perhaps the simplest of the sense-organs, though not as simple as it is generally supposed to be. It is usually connected with one sensation that of touch, but in reality it has four senses each with a distinct quality and

[1]Refer pp. 42, 43.

separate sense-organ. These are—cold, warmth, pressure and pain. The sense-organs connected with these sensations are known as spots and they lie beneath the epidermis or the external surface of the skin. Any given area of the skin contains all these four types of spots in different proportions. They can all be located if the skin is explored with suitable stimuli.

Take a comparatively hairless portion of the skin and mark off with ink a square inch on it. First pass over this area point by point a fairly cold needle. At certain points there will be felt an unmistakable sensation of cold. These points represent the cold spots. At other places there will be no sensation at all. Our stimulus has been contacting some other kind of spot and hence there has been no response. Cold spots are perhaps the easiest to find. Warmth spots are a little more difficult. They lie deeper down in the skin than the cold spots. An adequate stimulus for the warmth spots is a fairly hot needle, which is passed over the skin exactly in the same way as we did for discovering cold spots. The temperature of the skin varies at various places. On a cold day the exposed parts will be colder than the unexposed. The temperature of a given portion of the skin, at a given time, is known as the *physiological zero point*. For a warmth stimulus to be effective its temperature must be above the physiological zero point.

Normally speaking, a cold spot is responsive to only cold stimuli and a warmth spot to hot stimuli. But occasionally it may so happen that a cold spot is put into activity by a warm stimulus. When this happens, the resulting sensation is not warmth but cold—this is known as the *paradoxical cold sensation*. A cold spot always responds with a sensation of cold, irrespective of the stimulus that called it forth into activity. Similarly, it is possible to have paradoxical warmth sensations.

The pain spots are easily located and are the most numerous. This is a protective device which warns us of danger to the body. Though very sensitive, they lie deep down in the skin and the intervening portions are not sensitive to pain at all. This means that for a pain spot to be thrown into activity the stimulus must penetrate fairly deep into the skin. This again is a protective device which prevents us from getting

unnecessarily alarmed by the danger of pain. It is easy to locate the pain spots with a pin.

Pressure spots are more numerous than cold or warmth spots, but less than pain spots. They are distributed over the whole surface of the body. Each hair ending in the skin contains a pressure spot. They also occur in the hairless regions. To discover these the skin should be explored by a horse-hair or bristle, much in the same way as we did for the other skin sensations. The pressure exerted on the skin must be uniformly even and not too intense, otherwise the resulting sensation will be pain and not pressure. H. Head has shown that we also have a "deep pressure sensation"—"a system of sub-cutaneous sensitivity by which intense pressure stimuli are appreciated often with the accompaniment of pain".

5. Gustatory Sensations

One of the most important questions that we should ask in our analysis of the nature of the various senses is—how many elementary sensations does each sense-organ provide? We have seen that in the case of the cutaneous sensation it is four. The same is true of taste. The four elementary tastes are—salt, sweet, sour and bitter. The different sensations cannot be connected with different parts of the tongue easily but speaking roughly we may say that sweetness is perceived on the tip, sourness on the sides, bitterness on the back and saltiness on both the tip and the sides of the tongue.

The real organs of taste are the "taste buds" which are concealed well beneath the external surface of the tongue. Food to be tasted must first be broken up and dissolved either by saliva or water and sink through the innumerable small pits on the tongue into the taste buds.

The statement that there are only four elementary tastes must come as a surprise to many of us. We are surely conscious of many more tastes than that—the thousands of tastes that a skilful cook manufactures in the kitchen. In reality all these "tastes" are merely additions made by the olfactory and tactual sensations to the four elementary ones. Temperature seems to modify taste. Iced coffee tastes different from hot coffee. Roughness or smoothness of the object tasted also

makes a difference. Pulverized sugar does not taste the same as granulated sugar. As these two types of sugar come into contact with the roof of the mouth, the skin sensations that they produce are different. But smell has much more influence on taste than touch. Many of our so-called delicate tastes are really smells that reach the nose through the air passages that connect it with the mouth. This is borne out by the fact that a strong cold destroys most of our taste sensations.

7. Olfactory Sensations

We seem to know very little about this sensation.[1] The organ of smell is the olfactory membrane, situated in the upper nasal cavity.[2]

How many elementary smell sensations are there? Some have suggested nine but experimental evidence so far obtained seems to favour six. These are—spicy as in cinnamon, fragrant as in vanilla, ethereal as in ether, resinous as in turpentine, putrid as in hydrogen sulphide, burned as in tarry substances.

It is possible that different parts of the nasal membrane are connected with different types of smell. In certain diseased conditions the patient may lose his sensitivity to certain smells alone, while retaining others. Even people whose sense of smell is normal get fatigued by a certain smell, if they continue to smell it for a long time. Thereupon a period of insensitivity to that smell intervenes. After one has smelt camphor for a long time, alcohol will not be noticed but iodine will still have its usual effect.

The difficulty of isolating smell sensations is increased by the fact that, as in the case of taste, they are usually mixed up with other sensations (tactual and olfactory). The sweet odour of chloroform is largely a matter of taste.[3] The characteristic odour of ammonia is largely pain and it is the resulting holding of breath that gives the sense of suffocation.

[1]It is possible that with the progress of evolution there has been a corresponding deterioration of the olfactory capacity. Man's sense of smell compares poorly with that of the dog.

[2]Not a very accessible place and perhaps this is the reason why experimental data is not as easy to obtain here as in the case of certain other senses.

[3]It is significant that a smell should be labelled by a taste.

7. Auditory Sensations

The ear is divided into three parts—the external, the middle and the inner ear. The external ear is made up of the pinna (what we ordinarily call the ear) and the tube that runs inside. Its only function is to gather the sound waves and carry them in. The middle ear extends from the tympanic membrane to the oval and round windows of the inner ear. It is an irregularly shaped cavity in the skull, across which extends a chain of three bones named after their shape, the hammer, the anvil and the stirrup. The middle ear is connected with the throat by means of the eustachian tube and thus kept constantly supplied with air. The inner ear extends right back into the skull and is made up of three parts—the semi-circular canals, the vestibule and the cochlea. The semi-circular canals have nothing to do with hearing but with our sense of equilibrium. The vestibule is merely a receiving and transmitting centre. The real organ of hearing is the cochlea. This is a shell-like structure that winds itself round two and a half times—an anatomical device for saving space. Inside the cochlea running parallel to its structure is the basilar membrane. It is made up of a series of fibres which differ in length as the membrane passes from the lower to the upper extremity of the canal. The inner ear is water-tight and is filled with a saline liquid known as the perilymph.

When a sound wave enters the external ear the first thing that happens is that it pushes the tympanic membrane. This membrane is stretched tightly across the entrance to the middle ear and is very sensitive to sound waves. As it is pushed in it carries with it the series of three bones that lie across the middle ear. The hammer is in contact with the membrane while the stirrup fits closely into the oval window. This naturally results in the membrane that covers the oval window being pushed in also. In order to render a displacement of liquid of the inner ear possible, the membrane that covers the round window, situated immediately below the oval window, bulges out. The disturbances in the liquid of the inner ear are caught up by the fibres of the basilar membrane and sent up to the auditory area in the brain by means of the auditory nerve. When this happens we have the sensation of

hearing. After this process is over the tympanic membrane comes back to its original position, so do the membranes of the oval and round windows and the bones of the middle ear—all ready for the reception of the next sound wave. We must note that what originally began as an air vibration is transformed into a vibration in liquid in the inner ear before it is apprehended as sound.

8. A Theory of Hearing

But how exactly do the fibres in the basilar membrane catch the vibrations in the liquid around it. This is what a theory of hearing must attempt to explain. So far there has been only one satisfactory theory, the Helmholtz theory, also known as the "piano string theory", because in it a parallel is drawn between the strings of a piano and the fibres in the basilar membrane. If you open the lid of a piano and shout into it you will find that a string there corresponding to the tone of your voice starts vibrating of its own accord. This is so because of the principle of *sympathetic resonance*. The same principle is at work, claims Helmholtz, when a fibre in the basilar membrane starts vibrating—it vibrates in sympathy with the note represented by the liquid disturbance going on in the inner ear. Of course each fibre is tuned for a particular note and will start vibrating only if that particular note is represented by the liquid vibrations.

This is a possible theory. In the basilar membrane there are about 18,000 to 20,000 fibres whereas the number of tones that can be distinguished by the ordinary human ear is approximately 11,000. So there is no difficulty about there being one fibre for each tone. The lowest tone that may be heard has about twenty vibrations per second and the highest about 20,000 per second. The Helmholtz theory can explain this phenomenon by saying that there are no fibres in the ear that can vibrate sympathetically below and above this range. There is also some evidence to show that certain parts of the basilar membrane are connected with certain tones and this evidence is indirectly in favour of the theory. There are some people who are deaf to certain notes while they can hear others clearly. When the basilar membrane of some

of these people was examined after death it was found that certain parts of it had been destroyed by disease. It was also found that in the case of many people who had high tone deafness that the region affected was the basal part of the membrane. Also an examination of the cochleas of animals which have been stimulated for a long time with loud tones has often revealed changes in the structure of the basilar membrane, generally the basal part. There thus seems to be a good deal of evidence not only in favour of the Helmholtz theory but also for the hypothesis that the basal portion of the cochlea is involved in the hearing of high tones.

But a doubt is sometimes raised as to the probability of fibres as short as those in the basilar membrane ranging in length from ·04 mm. to ·48 mm. vibrating in sympathy with the lower tones that can be heard. The parallel of the piano string does not hold good as far as length is concerned. Several authorities have asserted that the fibres are too rigid to vibrate to faint tones.

9. An Analysis of Sound

The stimulus which causes the nervous excitation which results in sound is longitudinal air vibrations. When a vibrating body strikes the air the particles about it vibrate backward and forward and successive waves of rarefaction and condensation result. These waves are carried forward in all directions until they come into contact with some receiving surface like the ear or the receiver in a wireless set. Air waves which cause sound differ in three ways: (1) In the rate of vibration—this is what is known as pitch or tonal quality. A tone may be high or low. (2) In amplitude this is the distance through which the particles vibrate. This is what gives to a tone its intensity or loudness. (3) In form or complexity—this is what is known as timbre. This gives the same note produced on different musical instruments their characteristic quality. For example, the middle C of a violin differs from that of an organ.

A noise is a combination of different types of vibrations, a tone a sequence of uniform vibrations.

10. Visual Sensations

The receiving organ for visual sensations, the human eye, is an independent organ placed securely in a bony cavity in the skull. External muscles hold it in place and enable it to move itself independently of the head, thus increasing the range of vision considerably. Only a little part of the eye is visible to us as part of the face. The eye is a ball, kept in shape because it is filled with a jelly-like substance. It is made up of three layers—the external coating is known as the sclerotic, inside it is the choroid coat which is darkly pigmented and serves the useful purpose of preventing the incoming rays of light from being reflected back. The third layer is the real seat of sight, the retina. It is made up of a series of layers of cells distributed all over the inner surface of the eye. These cells are known as the rods and cones.

The sclerotic coat is opaque but when it reaches the front part of the eye it becomes transparent and bulges out slightly. This bit is known as the cornea. The dark circle in the eye that we see is merely a part of the choroid that is visible through the transparent cornea, the iris. In the centre of the iris is a hole, the pupil of the eye, which lets in the light into the interior regions. Like the diaphragm of a camera the pupil can be broadened or narrowed according to the intensity of the surrounding light conditions. Back of the iris is the crystalline lens which is also adjustable and is controlled by a pair of ciliary muscles, one on either side. It is by means of this lens that we are able to make the incoming rays of light fall exactly on the central portion of the retina—the fovea centralis. The transparent convex cornea also acts as a lens. Between the cornea and the iris is the anterior chamber of the eye filled with a substance very much like water, known as the aqueous humour. Back of the lens is the posterior chamber, the big hollow of the eyeball, which is filled with a clear semi-fluid substance known as the vitreous humour. These two humours also play some part in directing rays of light to the central region of the retina.

The rods are receptive to light and shade and the cones to colour. The central part of the retina is full of cones and this is the region where colours are seen clearly. The outer

part or the periphery of the retina is very sensitive to light and shade and here the rods predominate. If a coloured light falls on this region the observer will experience a colourless sensation.

11. Colour Mixing, Colour Contrasts and After Images

There are seven colours in the spectrum visible to the naked eye—violet, indigo, blue, green, orange, yellow and red. Beyond violet is the ultra-violet the rays corresponding to which, though they cannot be seen, have considerable curative properties and are used therapeutically. The same is the case with the light at the other end of the spectrum, the infra-red, which is used in long-distance photography. Two colours which are opposed to each other in such a way that when mixed together yield a grey are known as complementary colours. There are two such pairs of complementary colours—red and green, yellow and blue.

If at a given point the retina is stimulated at the same time by two rays of different coloured lights, other than complementaries, the resulting process is a compromise between these two colours. For example, if a ray of red light and a ray of yellow light fall on the same cone at the same time, the observer will see orange, which is the colour intermediate to these two in the spectral series. If now we use red, yellow and blue at the same time, the resulting process is a neutral grey. In such cases the retina is not capable of making a compromise and returns to a primitive state of colourlessness (grey). When all the colours of the spectrum fall at the same time on a cone, as is the case in full daylight, the result is a sensation of pure brightness or whiteness.

Yellow and blue appear yellower and bluer respectively when seen side by side than when seen apart. This is an example of what is known as *simultaneous contrast*. Such contrast can also be illustrated by putting a bit of grey paper on a coloured paper and covering the whole surface with a piece of tissue paper. The grey bit of paper will soon take on a colour which is complementary to its background. Thus if the coloured surface is red, the grey bit of paper will appear slightly green. This happens because the eye soon gets fatigued

for red and a process corresponding to its complementary colour is set up before retinal equilibrium is restored.

If a ray of light acts on the retina for a sufficient length of time its effect will continue for a brief period, even after the external stimulus has disappeared. This is known as an *after image*. If the original impression and the after image is of the same quality then we have a positive after image. For example, if you look at the flame of a candle in a dark room for some time and then either close or turn away your eyes you still seem to see a flame before you for a few minutes. If the quality of the after image is different from the original impression, then it is known as a negative after image, and is an example of what is sometimes called *successive contrast*. In these cases every black changes to white, every white to black and every colour to its complementary colour. Thus, after looking at a brilliant red for some time, if the observer looks at a grey background he sees a bluish green colour which is the complementary colour for red.

12. Colour-blindness

This is the name given to the inability displayed by certain people to distinguish between colours. It is not a disease but a natural condition of the eye, due to the lack of development of certain zones of the retina. Colour-blindness may be of two types—total or partial. In total colour-blindness the subject sees all colours as mere variations of light and shade. We have seen that the outer zone of the retina where the rods predominate gives only sensations of light and shade. Suppose the whole of the retina is in this state, then total colour-blindness is the result. It is, however, very rarely to be met with.

Partial colour-blindness is more common. It generally takes the form of red-green blindness. In such cases the individual has sensations of yellow and blue but not of red and green. Of course, he is also sensitive to light and shade. According to the Ladd-Franklin theory of colour vision there is an intermediate zone in the retina which can give sensations of only yellow and blue, whereas the central zone is responsive to all colours. Suppose the central zone has only attained that level

of development which is characteristic of the intermediate zone, then this type of colour-blindness is the result. Red-green colour-blindness is rare among women but is present in 3 to 4 per cent of men. Yellow-blue colour-blindness is extremely rare, though a few cases have been reported.

13. Theories of Colour Vision

A good theory of colour vision must explain the following points: (*a*) the number of elementary colours, (*b*) colour mixture, (*c*) colour contrasts, (*d*) after-images and (*e*) colour-blindness. There are three well-known theories in the field. We may take up each of these and see how far they fulfil these conditions.

1. *The Young-Helmholtz theory*. This theory which is also known as the three-colour theory is the oldest of modern theories and was proposed by Thomas Young and amplified by Hermann von Helmholtz. It is based on the assumption that there are only three elementary colours—red, green and blue. Yellow, which is generally recognized as the fourth elementary colour, it looks upon as a compound of red and green. White is a blend of the three primary colours. Since all colours are produced by an appropriate mixture of red, green and blue it was assumed that in the cones of the retina there were three distinct substances and that each cone is supplied by three different types of nerve-endings corresponding to these three substances. Thus a red light would stimulate the red sensitive substance in the cone, this would excite an impulse in the red-conducting fibre and produce the sensation of red. Similar processes would take place for green and yellow. Stimulation of two of these substances resulted in an intermediate colour and when all the three substances were stimulated simultaneously, the result was white.

In criticism of this theory it may be mentioned that research has so far failed to reveal any three such distinct substances, as the theory claims, in the cones. Yellow is not a blend of two colours but has been acknowledged by most physicists and physiologists as a separate colour. Lastly it does not give us any explanation of colour-blindness.

2. *Hering's theory*. Ewald Hering assumed that there were

three substances in the retinal tissue and that these substances overlap to a certain degree. These substances he defined as pairs of colours—the red-green, yellow-blue and black-white substances. The two colours in a single substance stand in opposition to each other, so that if one is stimulated the other must also be thrown into activity later before retinal equilibrium is restored. If both the colours in a substance are stimulated simultaneously, they neutralize each other and a white is produced. The theory thus assumes three different pairs of metabolic processes in the retina, each pair consisting of two different and antagonistic processes, one anabolic and the other catabolic.

This theory is an improvement on the previous one. It gives us four primary colours and also accounts for colour mixture and colour contrasts. But no explanation of colour-blindness is given.

3. *The Ladd-Franklin theory*. By far the most satisfactory theory of colour vision in the field today is that propounded by Christine Ladd-Franklin. It is a genetic theory which assumes that our present colour vision is a development from a primitive stage of colourless vision. Thus the theory makes an evolutionary approach to the problem. In discussing the nature of colour-blindness we were taking a line similar to that taken by Ladd-Franklin. In a primitive stage of vision, far back in the history of creation, the retina was sensitive to only light and shade. It was incapable of seeing colour. Then at a certain stage it developed a second zone where responses were made to yellow and blue wave-lengths. Still later, a third inner zone was developed in the centre of the retina, which was responsive to all the four primary colours. In the human eye today there are three zones corresponding to these three stages of development.[1] In the completely colour-blind person the whole of the retina is in the first stage of development. In the red-green colour-blind person, the third zone is in the second stage of development, so that there are really two instead of three zones. In the first stage one response, white, is made to

[1]Perhaps man at a future date may develop a fourth zone where he can see ultra-violet and infra-red, colours which are at present invisible.

light waves of all lengths. In the second stage this single response is divided into two, the long wave arousing the response of yellow and the short wave that of blue. In the third stage, the long yellow wave is further divided into red and green. This disintegration and reintegration of colours takes place unconsciously, probably in the retina itself.

Ladd-Franklin is of the opinion that this whole process of appreciating differences in wave-lengths is chemical in nature. She supposes the existence of light sensitive *mother substances* in the rods and cones, which are decomposed by the action of the incoming waves of light and give off *cleavage products* which initiate nerve currents that reach the brain.

The Ladd-Franklin theory offers us the most satisfactory explanation of all the important phenomena connected with vision, including the most difficult of them—colour-blindness.

14. Kinesthetic Sensations

This sense gives us information about the movements of the body, about its resistance to other bodies and about the weight of various objects that we lift with our hands. When one lifts a heavy weight there is noticeable over and above the pressure sensation in the hand, a feeling of strain in the arm. Such a sensation is also felt when the hand is firmly clasped. This sensation is more than a skin sensation, because it has been found in people who have lost all such sensation. If the judging of weight is merely a matter of pressure, then we must be able to say immediately we lift an object, how heavy it is. But actually we are not able to do so unless we move our hand up and down several times. It is therefore only reasonable to suppose that we have some special means of detecting movement and weight over and above such help as the touch sensation may give us. This special means is the kinesthetic sense.

One of the places where this sensation originates is the "muscle spindles" which are imbedded in the muscles of the body and are connected with sensory nerve fibres. Other sense-organs exist in the tendons and about the joints. When the arm, for example, is bent double there is a contraction of one set of muscles and a relaxation of another set. In one set

of muscles, the muscle spindles will be pressed whereas, in another set, they will be relaxed. Sensations coming from these muscles spindles enable us to know the exact position of our limbs, when our eyes are closed.

15. Organic Sensations

Hunger and thirst are the most familiar examples of this sensation. The former originates in the membranes of the stomach and the latter in the back of the mouth, very near the throat. It is possible that there may be special organs which inform us of disturbances in the respiratory and circulatory systems but as yet very little is known about them.

16. Static Sensations

The semi-circular canals in the inner ear are the seat of this sensation. These canals are filled with a fluid which is disturbed when the body is in violent motion—as in the case of sitting in a merry-go-round. Hairs project in the liquid of the canal and when the liquid is disturbed the hairs are moved and they set in motion impulses which are carried by the nerves connected with them to the motor area in the brain, which controls the movements of the body. Then appropriate adjustments are made to restore the equilibrium of the body. When the semi-circular canals are injured a person naturally loses his sense of balance and proper motor adjustments become impossible.

17. Weber's Law

The law attempts to trace a connection between the intensity of a stimulus and the intensity of the resulting sensation. We all know that the more energy there is acting upon the sense-organ, the greater is the intensity with which the consequent sensation is felt. Two lights are brighter than one, the sound of two explosions is louder than the sound of one. Common sense recognizes such phenomena as cases of simple addition. Weber's law tells us that it is much more than this.

The intensity of a sensation cannot be accurately described in words. Weber's law makes use of comparison as a con-

venient means of gauging one's ability to estimate differences in intensity. Supposing a man is asked to take two weights, one weighing 8 lb. in his right hand and one weighing 7 lb. in his left and then judge which is heavier. Supposing that he says that the 8 lb. weight is heavier. Then we can reasonably assume that the 8 lb. weight created in the man a more intense sensation than the 7 lb. one. Starting from this matter of comparison of weights, Weber went on to develop the more positive aspects of his law. He discovered two important principles at work, as he compared the results of various experiments at weight-lifting. These were:

1. Sensations seem to increase in amount very much more slowly than stimuli increase in intensity. For example, a 4 lb. weight does not produce in one a sensation which has the double the intensity of a 2 lb. weight; 100 ozs. does not give a hundred times more weight sensation than 1 oz. does.

2. There is a definite mathematical relation between the increase in the amount of the stimulus and the increase in the intensity of the sensation.

The basic principle behind Weber's law can be summed up thus: "In order that the intensity of sensation may increase in arithmetic progression, the stimulus must be increased in geometric progression." For example, suppose that a ping-pong ball is dropped on to a wooden surface from a distance of 2 ins. and then from a distance of 4 ins. and you are able to distinguish between the intensities of these two sounds. The next difference between two intensities that you will be able to recognize as similar to the first difference is not 4 and 6 ins. but 4 and 8, 8 and 16, 16 and 32 ins., and so on.

As a corollary from this law, is derived the following—"The smallest perceptible difference between two stimuli is not *absolutely* but *relatively* the same." Thus if we could distinguish between two weights, one 17 ozs. and the other 18 ozs., by lifting them successively in our hands (that is if we could distinguish an increase of $\frac{1}{17}$) we cannot be expected to distinguish between 34 ozs. and 35 ozs., but we should be required to add to the 34 ozs. the same relative amount as in the previous case, i.e. $\frac{1}{17}$. Since $\frac{1}{17}$ of 34 ozs. is 2 ozs. the

smallest difference between 34 ozs. and another weight above it that you can distinguish is 36 ozs.

Concerning this law Mellone and Drummond remark "the law is true only approximately and within certain limits. Experimental verification in the case of taste and smell has not been possible. In the case of temperature the results are uncertain. The law has been approximately determined in the case of hearing, sight, pressure and the muscular sense. It holds good with fair amount of accuracy in the middle region of the sensory scale. Towards the upper and the lower limits the results become quite uncertain".

Fechner[1] has expressed the mathematical part of the law as follows:

$$S = C \operatorname{Log} R$$

S stands for the intensity of a sensation, R for the stimulus and C for a constant factor. This constant factor varies in different sensations, for sight it is $\frac{1}{100}$, for smell it is $\frac{1}{4}$.

A good example of how we make use of this law in daily life is to be found in the prices we pay for seats in a theatre. Suppose there are five rows of seats at a certain price, it is obvious that the fifth row is farther away from the stage than the first row. Yet we do not mind paying the same price for a seat here as we do for a seat in the first row. This is because we recognize the fact that this little difference between the first and the fifth row does not materially affect the sound and sight sensations coming from the stage. We have implicitly recognized that sensations increase or decrease in intensity much more slowly than stimuli.

[1]Weber's law is also known as the Weber-Fechner law. G. T. Fechner lived from 1801–87 and was a contemporary of Weber (1795–1887). He was mainly responsible for formulating the mathematical part of Weber's principle.

CHAPTER VI

ATTENTION

1. A Much Neglected Subject

The process of attention was much neglected by the earlier psychologists. This was mainly due to a peculiar theory of the mind then prevalent. The philosopher Locke (1632–1704) whose writings had considerable influence on psychology had claimed that the mind was a *tabula rasa*—an empty slate on which stimuli from the outer world came and made their impression. Thus the mind had only a passive part to play in the acquisition of knowledge. Since stimuli took the initiative it did not matter whether one attended to them or not. It was much later that this passive view of the mind was given up in favour of a dynamic view. It was realized that there was a volitional factor in knowledge, that stimuli became part of our system of knowledge only when we attend to them. If we merely received impressions passively from the outside world then we should be victims of circumstances—there would be no point in either praising or blaming any one for the amount of knowledge he has, since the amount was not of his seeking.

Attention is one of the subjective factors involved in the story of knowledge. It lies in our power to pick and choose from the diversity of phenomena around us certain parts as objects of our attention. "Attention is the taking possession by the mind, in clear and vivid form, one out of what seems several simultaneously possible objects or trains of thought."

Unless sensations are attended to they cannot become real to us. Attention thus occupies a pivotal position in the process of acquiring knowledge. Apart from theoretical considerations, it is a subject of immense practical importance. All educationalists are interested in the question of how to sustain the attention of students in the class-room. The student himself is anxious to know how to keep his attention pinned down to

a text-book, especially if it happens to be a dull one. In this age of mass-produced goods it is an important matter to catch the public eye and psychological researches into the nature of attention have improved the technique of advertisements immensely.

2. The Span of Attention

William Hamilton was one of the first psychologists to start experimental studies in the subject. His earlier experiments centred round the *span of attention*, i.e. the number of objects that one can take in at a single glance or pulse of attention. A number of objects of the same variety, say marbles, were put on a table covered up by a cloth. Then the cloth was removed and the objects exposed to a subject for a second or two. He was then asked to say how many objects there were on the table. It was found that the span for marbles was about six, for numbers about seven. The invention of the tachistoscope, a board with a slot and a shutter very much like a camera, by the help of which a long series of letters or numbers could be exposed to a subject for the fraction of a second, was of very great value for experimental studies in attention.

3. The Stimulus in Attention

At any given moment in a man's life stimuli press around him in all directions competing for his attention. What makes him select the particular stimulus that he does to attend to and neglect the others? Experiments have revealed that there are several factors that influence a man's tendency to attend at a particular time.

1. *Change.* A changing stimulus has an advantage over a stationary stimulus. A moving picture catches our eye better than a still photograph, an advertisement where the lights come and go off better than the one which is permanently illuminated.

2. *Strength.* Of two stimuli, the stronger one has an initial advantage over the weaker, other conditions being the same. If two people are trying to make us hear them the one that shouts louder naturally succeeds.

3. *Size.* What was said of strength applies equally well to size, the bigger the stimulus the better the chances of its catching our attention. If an elephant and an ant come towards us, marching side by side, most of us would notice the elephant first.

4. *Repetition.* A poster that is repeated several times on a wall, say at a distance of one yard each, is read by more people than the one that is not thus repeated. When an orator wants to drive a point home he repeats it more than once. But repetition is valuable only within certain limits. Over-repetition defeats its own purpose. If a *motif* is repeated too often it becomes monotonous and one loses one's interest in it. A man who repeats himself too often becomes a bore.

5. *Striking quality.* Anything that is strange or out of the way at once attracts our attention. It has a peculiar striking quality because of its very quaintness. A man who plays cricket dressed in complete black at once attracts attention.

6. *Definite form.* One of the schools of modern psychology, the Gestalt school, has shown by a series of experimental studies that anything that has a definite form is attended to much more readily than anything that is vague. A tune has an advantage over noise and a picture over a series of scribbled lines.

7. *Habits of attention.* As children we are taught to attend to certain types of stimuli and neglect others and these habits of attention determine to a large extent the trend of our attention in later life. For example, we are always taught to respect age and listen politely when old people are talking. Even after we have grown up we continue to listen to what old people say, though we may often be convinced that they are saying nothing worth while.

8. *Momentary interest.* All the previous factors that we have listed are completely over-ridden by that of interest. We attend to things that we are interested in for the time being. A man who has lost a rupee goes about looking at all round white objects. So anxious is he to find the rupee that he may neglect to see a sovereign lying right in front of him.

4. The Sustaining of Attention

The various types of stimuli that we considered in the previous section have the power of attracting our attention,

but this is not enough. The attention that has been aroused must be sustained. There are certain factors that help us to keep our attention pinned down to a particular object. These are:

1. *Present desire or interest.* Why is it that once we start reading an interesting novel we are loath to stop in the middle? It is because of the interest that the characters have aroused in us. We are keen to follow their fortunes. Our attention is whole-heartedly given to the book without any conscious effort.

2. *Curiosity.* Present desire often takes the form of curiosity, which is another great sustainer of attention. We can understand our attention being pinned down to a good novel but why is it that we sometimes patiently plod through a dull one? It is because our curiosity has been aroused, a question has shaped itself in our mind—"Will the hero live or die?" and to get the answer we are prepared to read several pages of dull matter.

3. *The mastery impulse.* Often a dull book is a challenge to us. Other people may give up reading it after glancing at the first few pages, but we are made of sterner stuff. We read the book attentively in order to show the world that mere dullness is not going to beat us.

4. *Fear of punishment or hope of reward.* Schoolmasters in olden days relied too much on these methods to sustain the attention of their pupils. The cane was hung behind their desks to remind boys of the consequences of waywardness. The prize distribution at the end of the year was intended to encourage the attentive boy. It is now being increasingly realized that such artificial means of sustaining attention are not really in the best interests of either the pupil or the school. Especially is this true of fear of punishment. Any course of action based on fear cannot be really healthy.

5. *A genuine interest in the subject.* This produces the best motive for sustaining attention. We must attend to a thing not because we are afraid of the consequences if we fail to do so, but because we really like the thing. A pupil must listen to a teacher because his teaching is good and not because there is something behind his chair.

5. Stages in the Development of Attention

Though a genuine interest in the subject matter is the best way of sustaining attention, often it takes considerable time and effort to develop this interest. We must study the subject for a considerable time before we may learn to appreciate it. Attention has generally to pass through two other stages before that of objective interest is reached. These are:

1. *Curiosity*. Often it is mere curiosity that attracts our attention to an object. Once the edge of our curiosity is worn out and we know what it is all about, we may get bored and become inattentive. But other considerations like fear of consequences or politeness may compel us to go on attending to the thing, though it no longer grips us. But when we have done this for sometime, we may find that we have developed a genuine interest in the object itself and when this happens there is no fear of our attention wandering. For example, walking idly along a street in an evening you may see somebody talking to a crowd of people at the corner. You are curious to know what it is all about and join the crowd. You may find that the man is giving an election speech. He rattles off a catalogue of his virtues. You get bored soon and want to come away but suddenly discover that the speaker is a friend of your brother's who comes to your house often. He has caught your eye and you feel that it would be rude if you come away now. Soon the points that he makes begin to interest you. You ask yourself questions like, what particular programme has this man? What reforms does he promise to bring about if he is elected? You thus get really interested in the matter and stay on till the end. Your attention has gone through all the three stages of development.

6. The Shifting of Attention

We have been saying a good deal about the concentration of attention. Such concentration is both possible and desirable, but it must be noted that though we may concentrate our attention with great intensity on a particular object, yet it is shifting within the radius of that object. Suppose we look intently at the face of a man we will find that though the face

is before us all the time, yet our attention is moving from one part of the face to another. Now we may be looking at the nose and now at the eyes and so on. Other people watching us as we watch the face will find that our eye is actually roving. Look at diagram on the opposite page. If you stare at it intently you will see it as three cubes sometimes and as a star some other times. Why does the same picture produce different effects on us? It is because our attention shifts and the lines of the figure are seen sometimes as a particular combination and sometimes as a different combination.

7. The Fluctuation of Attention

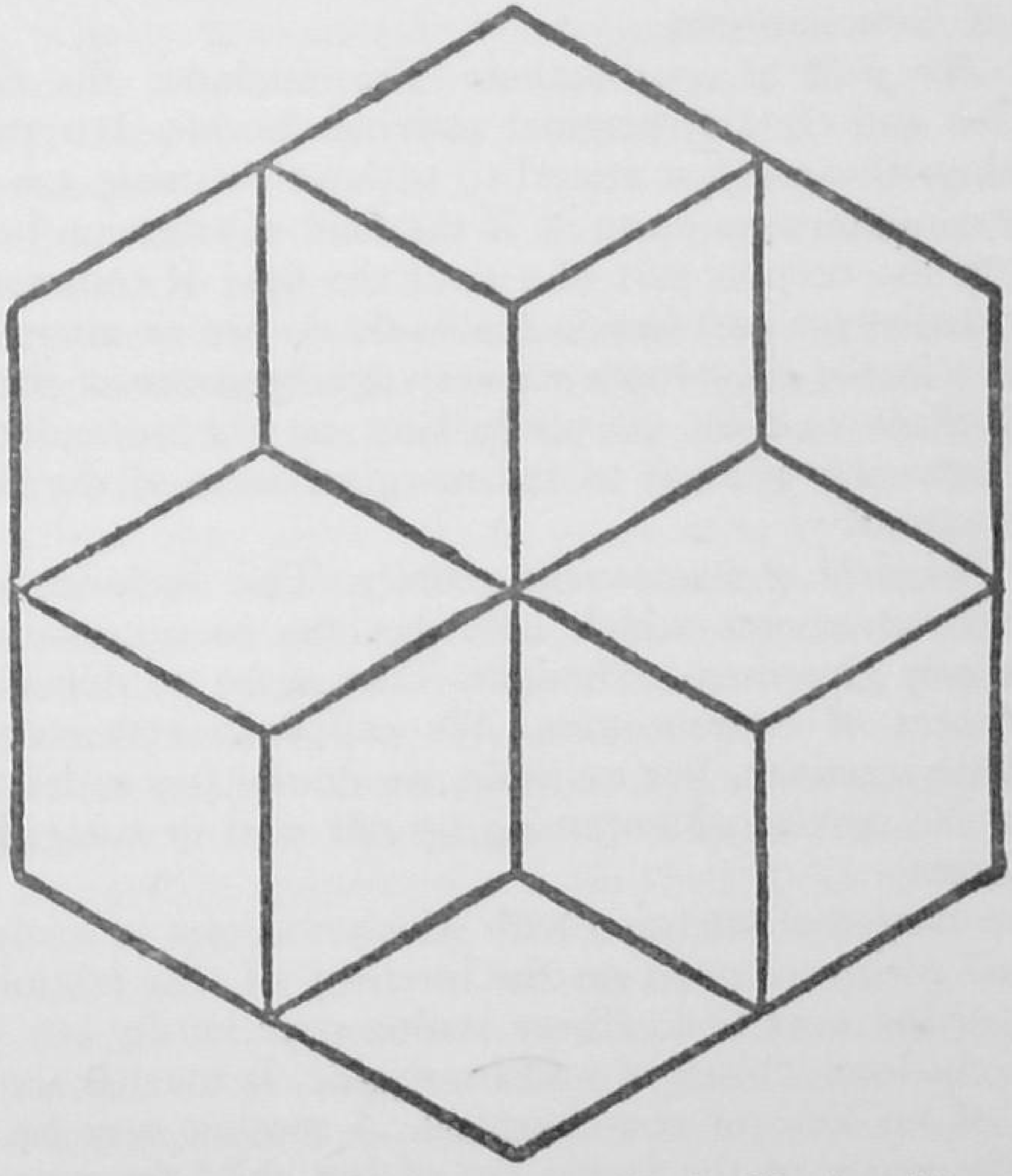
Besides shifting attention also fluctuates. We cannot attend to a thing with the same amount of intensity all the time. There is a waxing and waning of the attentive process which is independent of our will. For example, if you are attending to a lecture and are anxious to get every word that the lecturer says, in spite of your desire you will find that sometimes your attention tends to flag. This is merely the general physiological law of fatigue coming into operation. If the stimulus is a prolonged one the sense-organ is liable to get tired and there follows a period of less intensity before the organ regains its original powers.

8. Varieties of Attention

1. *Active and passive.* Of course, there can be no such thing as completely passive attention. We have seen that all attention involves mental activity of some type. This distinction is therefore one of degree. Active attention takes place when there is an effort of the will. This is also known as voluntary attention. We attend to an object not because we are instinctively drawn towards it but because we force ourselves to attend to it. In passive attention the effort of the will is not so pronounced. It is a spontaneous affair, there is something in the thing itself that compels our attention.

2. *Immediate and derived.* In immediate attention we are interested in the thing attended to for its own sake; in derived attention the thing is attended to as a means towards some other end. Our attention in a circus is immediate, we are

interested in the feats themselves; our attention to a dull lecture is derived, we force ourselves to attend to it as a means to the passing of examinations. Children mostly have the immediate type of attention. They just go on attending to things as they happen to come along, purely for their own sake. They are not utilitarian in their attitude, they refuse to attend to things that do not interest them. They attend whole-heartedly, losing themselves, so to speak, in the object that attracts them. This spontaneous factor slowly disappears as one grows older. We attach certain artificial values to things, we attend to those matters which are advantageous to us, though dull in themselves. For example, a child may refuse to attend to the talk of his rich uncle and may even frankly tell



The Ambiguous Cubes. (From R. S. Woodworth's "Psychology", by kind permission of Methuen & Co.)

him he is a bore while the adult similarly situated pretends to be greatly interested in his talk in order to be in his good books.

9. Degrees of Attention

Since attention is the focusing of our consciousness on certain objects the degrees of attention are dependent on the degrees of consciousness. Consciousness shades off from high light to dim background. Three degrees of consciousness are generally recognized:

1. *The field of attention.* This is what we may call the central point of attention, where our consciousness is completely focused on the object. The object is in the centre of the picture as it were. It represents the maximum or the high light of consciousness.

2. *The field of consciousness.* This includes the field of attention and certain marginal activities beside. It represents the things that we just attend to without focusing too much of our consciousness on to it. If the field of attention be compared to the deepest part of a river the field of consciousness is the shallowest part beside the bank. As we sit attending to a lecture in the class-room we are vaguely aware of the singing of birds outside, people talking on the verandah, etc. Such awareness belongs to the marginal zone of the field of consciousness.

3. *The field of unconscious activity.* This includes all our habitual movements which have become so automatic that we scarcely give them a thought. They make no demands on our powers of concentration. We call such acts secondary automatic reactions. For example, we do not pay much attention to the process of buttoning up our coat or tying up our shoe laces.

The degree of attention with which we react to a stimulus does not always depend on the intensity of that stimulus. A person living next to a railway station pays hardly any attention to the loud whistle of a steam-engine. It touches the mere fringe of his field of consciousness. A mother may be more intensely aware of the feeble cry of her child far away than much more intense noises nearer.

10. Distraction

This is the negative aspect of attention. It is a stimulus "that attracts attention from the thing to which we mean to attend". The overcoming of distraction is an important matter for the management of attention. A man who is the prey of every distraction that comes his way is one who is utterly lacking in powers of concentration and is sure to come to grief in the long run.

Distractions are of many types. They may be internal, external or ideational. A student cannot concentrate his attention on the book he is reading if he has a severe pain inside him. The pain is an internal distraction. External distractions may be caused by the competing claims of several stimuli. You cannot attend to a lecture in a class-room if a band is playing a lively tune outside the college. Often students find it difficult to attend to their books because their "thoughts wander". Here the distraction is ideational. A train of ideas take possession of the mind. They so absorb our attention that we find that the task that we are supposed to be attending to is completely neglected.

There are several ways in which distractions can be overcome.

1. The obvious way is *to get rid of the distraction*. If you are reading and a friend comes in and begins to talk loudly it is always open to you to push him out and close the door.

2. Or you may allow him to go on talking but put more effort into your reading. You may concentrate more, start reading aloud, or bend your head nearer to the book. Here you are *throwing greater energy into the task you are performing* in an attempt to overcome the distraction.

3. We may also overcome distraction by forming a habit of inattention to the distracting stimulus. This process is known as *negative adaptation* and we shall study more about it when we come to learning. When a distraction is present with us constantly we learn to disregard its presence in course of time. People living near railway stations are not at all disturbed by the noise made by incoming and outgoing trains, whereas to a newcomer to that locality it is a powerful source of distraction.

4. Lastly, we can *couple the distraction with our main task*

and thus rob it of its sting. This is the method of carrying the war into the enemy's camp. The distraction becomes an ally instead of a hindrance. Woodworth gives us the example of a person who is learning to play the piano. He plays with the right hand and finds the left hand a source of distraction for he does not know what to do with it. Finally he gets over the difficulty by playing with both hands. The distracting left hand is now made into an ally.

11. The Laws of Attention

The laws of attention partake of the general nature of the laws of reaction. We have already noticed some of these laws in our study of the characteristics of attention. We may briefly sum them up thus:

1. *The law of selection.* Out of several possible stimuli we generally select one and concentrate our attention upon it. When this happens all the other competing stimuli lose their attraction.

2. *The law of advantage.* We saw that all other conditions remaining the same, certain types of stimuli have an initial advantage over others in the matter of claiming our attention.

3. *The law of shifting.* We also saw that attention is always mobile and never stationary. Though we may fix our attention on a particular object it always keeps shifting within the radius of that object.

4. *The law of sustained attention.* We noticed that there are certain forces at work that help us to sustain our attention even though the stimulus that called it forth loses its original attractiveness. Forces like the mastery motive, habits of attention and fear. Attention can also be sustained by developing an objective interest in the stimulus.

5. *The law of combination.* We may combine two or more stimuli together and attend to them as a single unit. For example, the various stimuli coming from different parts of a face are put together and we attend to the face as a unit.

6. *The law of degrees of consciousness.* An attentive response is conscious to a higher degree than any inattentive response made at the same time. Even within the field of attention there are gradations.

CHAPTER VII

PERCEPTION

1. What is Perception?

In studying perception we enter the third stage in the story of the development of knowledge. Sensations are meaningless unless attended to. Attention makes them our own, but it is useless to own sensations unless we know what they signify. Sensations to be useful to us must be given a meaning. Perception is the process of understanding sensations or attaching meanings to signs. All sensations are signs from the outer world.

A thing becomes meaningful when you connect it with your past knowledge and see how it fits into it. For example, the college bell rings several times every day. Sometimes you do not attend to it, then it is lost to you. But when you hear it you do not stop there but say (not necessarily aloud) "that is the college bell". When you say this you are connecting this bell with your previous knowledge about bells; you are distinguishing it from railway bells, church bells, etc. The college bell will have no meaning to you unless you know different types of bells and distinguish one from the other. This knowledge is something that you carry stored up in your memory, it is part of your already existing system of knowledge. If a thing is absolutely new to you, if there is nothing about it which you can connect with your past knowledge, then you cannot perceive it. You may attend to it for hours together but it will have no meaning for you.

Perception involves also an inference. By referring a new sensation to your past knowledge you infer something about its nature. You refer the college bell to your past knowledge, compare it with other bells and infer that this must be the college bell. All this happens so quickly—the mind acts with lightning speed—that you are not aware that you have put in so much thinking work whenever you perceive.

2. Perception and Sensation

We may say that perception is the second response to a stimulus, sensation being the first one. Sensation is directly concerned with the stimulus, perception is directly concerned with the sensation and not with the stimulus that caused it. We perceive the college bell by attending to the sensation of the bell and not to the bell itself. Perception does not directly deal with the world of outward reality but with the sensations that these outward realities create in us.

If perception is the process of attaching meaning to sensation, then it follows that different people may assign different meanings to the same sensation or that we may attach different meanings to the same sensation at different times. As a rule we do not do this but are fairly consistent in our interpretation of sensation. Language, convention, custom and education all help us to fix the meaning of sensations more or less alike. When once a child has learnt to call a snake a snake it always calls it a snake, unless there are special circumstances present to mislead it.

Yet as our knowledge increases our perception of the same sensation may change. To an ordinary visitor the Taj Mahal is just a beautiful building, perhaps the most beautiful of all buildings. But the same visitor after studying architecture for some time may perceive the monument in a new light and see in it things that he had not seen before.

3. Perception and Action

What do we do after we have perceived a thing? In the scheme that we put up in a previous chapter we suggested that after perception comes conception. That is, we put several perceptions together and draw a general law, principle or idea out of it. Conception, however, is an intellectual process which we perform leisurely. What follows immediately after perception? Either nothing or action. You may be satisfied with your perception and just be happy in the knowledge that you have interpreted a sensation correctly or made an addition to your store of facts. Or you may *act* upon the information given by the perception and bring about some change in the external world. When you hear the college bell you may just say "there

goes the college bell" and keep quiet, or you may realize that you are late for college and begin to run. Action follows perception though all perception does not necessarily lead to action.

There are some psychologists who, however, claim that all perception involves action or movement of some sort. There seems to be some justification for this theory. We perceive facts and then act upon them. Perception comes first and then action. In actual experience the interval between action and perception is not so very marked as we generally think. In children especially, perception and action are very closely linked together. To the child seeing mother and running to her arms are both part of the same process. Perception and action is here continuous and indivisible. Some psychologists claim that this is the case not only with children but with everybody else. In the case of older people the action or movement that follows perception may not be very noticeable, all the same it is there. When a great violinist sees a violin he instinctively, it is claimed, makes a slight movement of his hand as if he is drawing the bow across the strings. When you are very hungry and perceive some food you make slight and almost imperceptible eating movements. When you see an enemy walking across the street there is a slight clenching of your fists. The action which is the result of perception is directed towards the object perceived.

True as this theory may be, it is desirable that there should be some interval between action and perception, and this interval should be spent in deliberation. The man who rushes to action immediately on perception is considered impulsive. To get the most out of perception it is essential for us to check hasty outward movements. Common sense has recognized the value of this. In daily life we respect people who first understand and then act. Proverbs like "Haste makes waste", "Look before you leap", all bring out the danger of precipitate action.

4. Characteristics of Perception

Since perception is the result of attending to sensations all the characteristics of attention are also characteristics of perception. Among these we may briefly note the following:

(1) Perception shifts. We saw that attention shifts. When looking at any given bit of stimulus we first attend to one part of it and then to another. The same is the case with perception. As we attend to one part of the stimulus we perceive that part and then as attention passes on to another part we perceive that part also. The ambiguous figure given to illustrate the shifting of attention may illustrate equally well the shifting of perception.

(2) Perception is a grouping and combining response. We put several stimuli together and make a joint response to it. When we perceive the face of a friend there are several stimuli coming to us from different parts of his face, eyes, ears, nose, etc. We put them all together and understand it as a totality.

(3) Perception is an isolating response. We saw that attention is selective. Out of the several possible stimuli, one is attended to and the rest sink into the background neglected. It follows from this that we perceive the thing that we select for our attention and do not perceive the things that are not attended to.

(4) Figure has advantage over background in perception—this is also another characteristic of attention. We attend to things that have a definite shape better than to things that are vague or indefinite. There are no gaps in nature and the human mind also hates gaps. It tends to fill in gaps and perceive things as having a definite form.

(5) Perception follows the "Law of Reduced Cues". Here at last is something new, something not directly dependent on the process of attention. A cue is a sign or signal. Applied to perception the law of reduced cues means that as we become more and more acquainted with an object, the signs by which we can perceive it become less and less till at last, a fraction of the original sign is enough for us to recognize that object. The more familiar we are with an object, the less of it do we need to recognize it. You are introduced to a man. The next time you meet him you have to stare at him for several minutes, take in as much of the stimulus as you can before you can recognize him. When you come to know him quite well the mere sound of his footsteps or the way he walks is enough for you to recognize him.

5. Trial and Error Perception

The great law of trial and error originally discovered by Thorndike as applicable to animals, applies to most forms of learning. Sometimes we learn to perceive correctly by trial and error, i.e. we first perceive something wrongly and then correct our mistake when we get better acquainted with the stimulus. Trial and error perception generally occurs when we are faced with unusual facts. You hear a strange noise, at first you may perceive it as something dreadful, the roar of a wild animal. You listen a little longer and perceive it as the droning of an aeroplane. Much of our knowledge is the result of a laborious process of trial and error and perception is no exception to this process.

6. Perception and Analysis

The more we perceive an object the greater will be our understanding of it. In the beginning we may just note its outline. But as we see it more and more we begin to note in detail the various parts of the object and how they are related to each other. At first we take in the object as a whole but later we pull it to bits mentally and see how each part fits into the main scheme. Perception involves analysis and this analytic side increases with the intensity of our perception. When you first see a new building, it is just a building to you. But as you see it every day you begin to analyse its structural qualities, the relative heights of the various floors, how many doors and windows there are, etc.

6. Perception of Space

We have ideas of space and distance so easily and naturally that we do not realize that these are the result of a slow process of growth and learning. The power to perceive space, shape, size and distance is not something that we are born with, but is the outcome of a good deal of education. This education starts immediately after our birth, and is so spontaneous that we do not realize that such a process is going on. Perception of space is nothing but learning the knack of interpreting a number of clues provided to us by different sense-organs. We now do it so very quickly that we forget that

originally we had to learn it at the expense of many mistakes.

The perception of space and time have been two of the big problems of philosophy and psychology. Psychological analysis of the process of space perception has revealed that it is an extremely complicated affair. The skill that the average adult has in this matter is largely the result of learning earlier how to interpret correctly certain signs which give us the clue to the estimation of distances.

Very young children evidently have no precise perception of space until they are able to move about and even then sometimes may make very amusing mistakes in estimating distances. When a child reaches for the moon it really thinks that it can get it. That the perception of space by vision is a matter of experience is also proved by the fact that when people born blind get their sight in adult life they are in the beginning wholly unable to form accurate estimates of space, size and distance. They collide against objects that can be easily avoided and try to avoid objects far away from them. Again, the same amount of space when perceived by different senses gives different impressions. The gap between two teeth when felt by the tongue appears much bigger than when perceived by the eye.

Psychology distinguishes three phases in the perception of space, namely:

(1) Perception of the body.
(2) Perception of distance on the surface of the body.
(3) Perception of distance away from the body.

(1) Perception of Body. If one is touched simultaneously upon the cheek and the back of the hand he probably receives from both parts identical sensations. Then how is it that we are able to distinguish between the two? The answer at first sight appears to be simple. We see with our eyes that we are being touched in two places. But if we eliminate eyesight we are faced with a difficult problem. How do the sensations coming from different parts of the body differ from each other? Wherein exactly does the difference lie? How do we ever come to know that a certain part of the body is being touched? Somehow we know that these things are happening.

They appear to be so simple that we hardly give the matter a second thought.

We may briefly consider three theories that psychologists have put forward to explain this phenomenon:

(*a*) It has been suggested that all touch sensations are not the same, as is generally assumed. If one is touched on the cheek and on the hand the two sensations will not be identical, the cheek sensation will be different from the hand sensation. It is this difference in individual sensations that enables us to recognize them as coming from different parts of the body.

"The local sign theory," as this is called, was first put forward by the German philosopher Hermann Lotze. Local signs are fixed elements in our space perceiving activity by the help of which we develop by experience a certain amount of accuracy in the perception of space. They are indicators of space positions. "They signify certain qualitative differences in perception according as the sensory experience involved is connected with one part of the body rather than another."

"Physiology seems to support the assumption that they exist. Scarcely two points on the sensitive surface of the body are anatomically alike. Nerve-endings differ in different places, the parts differ also in the nature of the tissue underlying them."

It must, however, be pointed out in criticism of the theory that no one has exactly described what a local sign consists of. They still remain mysterious entities that so far have eluded all attempts at discovery and analysis. Even if we assume that they exist, they cannot be looked upon as a complete guide to the perception of position on the surface of the body, for like all perception of space this is a matter of learning by experience. They may help us along with certain other clues to learn localization on the skin surface. "During the first years of life these local signs may be very imperfect guides. For example, a toddling child has been observed to knock the side of her head against something that came in her way and immediately after rub the other side of her head."

(*b*) Another theory makes use of different types of reflexes to explain our capacity for skin localization. It is claimed that each point on the skin has a different type of reflex con-

nected with it and it is with the help of these reflexes that we are able to say which part of our body is being touched. In the example that we took the part of the cheek that was touched will result in one type of reflex movement and the part of the hand that was touched will result in another type, thereby providing us with enough data to distinguish one from the other. If this theory is true then we must possess an enormous number of reflexes but physiological research has not so far discovered such a large number and it is extremely unlikely that it ever will.

(*c*) A third theory which we may call "the picture theory" claims that every type of contact on the skin creates in the mind a visual picture of the part touched. Introspective evidence has so far produced nothing in favour of this theory.

All three theories have failed because they attempt to give too easy an explanation of a difficult matter. "Knowledge of the shape and size of the body is not *given*, it is the result of experiment, observation and association. Movements of the body bringing it into contact with external objects are also followed by tactual sensations. When the child actively touches its own body it feels a sensation of *double contact*—in the part which it touches and in that which is touched; when he actively touches an external object he feels a sensation of *single contact*." These single and double contacts are of very great value in helping the child to distinguish its body from the surrounding objects. Single contact sensation means an external object; double contact sensation means its own body. The new-born child has probably no idea of its body at all and cannot distinguish it from the surrounding objects. When it accidentally catches hold of its own leg it may even think that it has caught an external object. From this state it slowly learns to differentiate its body from the rest of the world and *contact* is one of the clues that help it to do so.

Another clue that helps one to perceive his body as different from his surroundings is *vision*. As we grow up we see that we have a body with its several organs. We see these organs touch each other and other objects. As the body touches something hard we get a sense of pain; as the body touches something soft, like the mother's body, we get a sense of pleasure.

Thus pain and pleasure and the accompanying visual evidence of contact help to drive home our knowledge of self and the not-self.

Lastly, sensations of *movement* also help us. When we move about we have distinct sensations coming from the parts of the body moved. When we see other objects or bodies moving we do not have such motor sensations. They therefore heighten our awareness of our body and the lack of them deepens the gulf between our body and other objects.

(2) PERCEPTION OF DISTANCE ON THE SURFACE OF THE BODY. This is also a very complicated matter, difficult to analyse into its elements. The skill that we have acquired in estimating distances away from us is used in estimating distances on the skin itself. The most important factor that helps us to estimate distance on the surface of the body is *vision*. Distances on the skin are generally judged as visual distance. Suppose one is touched simultaneously at two points on the forearm, about 3 ins. apart, how does he know that the two points are 3 ins. apart? He looks at the two points and tries to estimate the distance between them. But once sight is eliminated a good many mistakes will be made in the estimation of such distance. Very short distances on the surface of the skin cannot be estimated at all and are generally perceived as a single point.

But we seldom try to estimate distance on the surface of the skin by the aid of one sense alone. The knowledge given by one sense is supplemented and corrected by another. This is a healthy tendency, for systems of distance are thus compared and any discrepancies in their estimation corrected. When such corrections are not made two systems of distances may remain independent and mistakes are apt to be made. A speck of dust that has fallen into the eye feels enormous while yet there, though insignificant when taken out. The information given by the touch sensations in the eye and the information given by the sense of sight very rarely get a chance of being compared and corrected.

(3) PERCEPTION OF DISTANCE AWAY FROM THE BODY. This is the perception of the third dimension. Every object is said to have three dimensions, length, breadth and width.

In perceiving an object away from us we try to estimate not only the width of the gap between us and the object but also of the object itself. This knack of estimating distances is the most complicated of all the three phenomena connected with space perception that we have been considering. Even after we have acquired a certain amount of skill our estimates are still only approximate. Several factors help us to estimate distances. We shall here briefly consider a few of the more important ones:

(*a*) Adjustments in the mechanism of the eye. We have noted that the crystalline lens of the eye may either be contracted or flattened out by means of the ciliary muscles that controls it. If one looks at a fairly distant object the lens is quite flat and in its normal state. There is, therefore, no strain on the ciliary muscles. But if we look at an object that is very near to us we have to round the lens by the help of the ciliary muscles and we have a sense of strain. In course of time we come to interpret a *feeling of strain in the eye* to mean that the object is very near to us and the absence of strain to mean that the object is at a fair distance from us.

(*b*) One of the curious facts about our sense of sight is that though we have two eyes and get two pictures of the object that we look at, one on each retina, yet we actually see only one object. When one looks at an object with both eyes the two pictures that he gets of that object are not exactly the same. Each eye looks at the object from a slightly different angle, so that the two pictures are slightly different. Somehow we acquire the knack of looking upon this *difference between the two pictures as equivalent to depth*. Of course, the whole process happens unconsciously and we are not even aware that we have two pictures. The same principle is made use of in the stereoscope. It appears truly a wonderful thing that two pictures when seen through this instrument appear not only as one but also as having depth. The stereoscope merely uses the principle of double images and the difference between them as equivalent to depth in the reverse direction. The same object is photographed from two slightly different angles, just as it would appear to our two eyes. When we see it we interpret

the difference as distance and get the illusion that the picture is extended out in space.

(*c*) Another important factor in the estimation of distance is the familiar fact that *the farther away an object is from us the smaller it appears*. Of course this presupposes an acquaintance with the normal size of that object. Only if an object appears smaller than what you know to be its usual size can you infer that it is at a distance from you. The painter makes use of this principle in landscape painting. He draws the more distant objects as smaller than the nearer ones and we naturally interpret it to mean distance.

(*d*) What is known as *haze* is another factor. Distant objects appear not only hazy and indistinct but also change their colour. They generally have a bluish tinge. Near objects have their own colour and appear clearly. This haze is dependent on the nature of the surrounding atmosphere. If the object is far away and the intervening air is full of dust and smoke, naturally light does not come through from the object easily and it appears dull and colourless. In big industrial cities only objects that are very near to a person appear clearly, because of the smoky atmosphere. On the other hand, in the country where the air is pure and clean, even fairly distant objects can be seen quite clearly without any trace of haze. If, therefore, people born and bred in a big city go into the country, they often make mistakes in estimating distances. Because an object appears quite clearly to them they think it is very near, but when they set out to reach it they are surprised to find that it is much farther away than they imagined.

(*e*) *Rate of movement* is another factor that helps. Distant objects seem to move more slowly, near ones more rapidly. An express train in the distant landscape seems merely to crawl, while when you go near to the same train it dashes past you. If from the top of a high tower you look at people walking below their movements are hardly perceptible. Of two objects moving roughly at the same rate, the one that appears to move faster is nearer to you than the one that appears to move more slowly.

(*f*) *Shadows* furnish a means of estimating which part of a big object, say a mountain, is nearer to you and which

farther away. Brighter parts of the object are generally nearer to the observer than shaded parts. But in estimating distance in this way care must be taken to observe from which direction the object is being lighted. What we have said would be true only if the light is falling from the front of the object. If the object is being illuminated from behind the reverse will be true.

(*g*) Another common-sense clue to the estimation of distances is the fact that objects that hide parts of other objects are evidently nearer than the objects hidden. This is what is called *super-position.*

(*h*) Fixing your eyes on a distant point, if you shake your head vigorously, you will find that the objects that are near you also shake and dance, while the objects that are far away are scarcely displaced. This *displacement* can also be made use of sometimes in estimating distances.

7. Perception of Space by the Ears

If an object is capable of producing a sound, for example human beings, birds and animals, and you know its normal quality, then its loudness or feebleness can also give you a clue as to how far the object is from you. You know the normal strength of your friend's voice; suppose you hear that voice loudly you at once know that he is near at hand. On the other hand, if you hear it feebly you infer that he is far away. But it sometimes happens that a loud noise made by a small object nearby is roughly equivalent in intensity to the normal noise made by a big object far away. When this is the case amusing mistakes are often made in judging distance by sound. The buzzing of a fly nearby may be mistaken for the droning of an aeroplane in the distance.

Not only the distance but also the direction in which the object producing the sound is situated may be judged by the ear. Sounds from the right side of the hearer affect the right ear more intensely than the left and vice versa. But suppose a sound comes from an object that is either right in front or right at the back of the hearer, it will affect both the ears equally intensely and no clue will be given as to the direction from which it is proceeding. On the *median plane* as this is

called, very big mistakes can be made in judging the direction of sound and one coming right from the front mistaken for one coming right from the back.

Those who have the sense of sight rarely use sound to judge distances but to the blind this is a major means of distance estimation. Blind people have, as a rule, uncommonly good powers of hearing. Not only are they very accurate in their auditory localization but they also use sound to obtain some idea of the nature of the ground on which they are walking and distance of obstacles before them. That is why so many blind men keep tapping with a stick as they walk. The sound of the tap when an obstacle is nearby is different from that when an obstacle is far away.

8. Perception of Time

"What is the time?" "Seven-thirty by my watch." The answer springs spontaneously to our lips, and is accepted at at its face value. Mankind has fallen into the habit of measuring time by some kind of a mechanical device and it is these mechanical devices that have invested the problem of time with an air of false simplicity. There is one feature common to all mechanical devices for the measurement of time. They rely on changes of some sort—change, in the position of the hands of the clock, the amount of sand in each compartment of the hour-glass or in the shadows on the sun-dial.

The following two factors help us to estimate time:

(*a*) *Change*. Change seems to be one of the major clues for the measurement of time. But the change measured by mechanical devices like the clock is concerned with an arbitrary division of time. There is no reason why a day should be divided into twenty-four hours and not forty-four or an hour into sixty and not forty minutes. Changes in the natural forces of the universe help us to appreciate time in a less artificial way. For example, from sunrise to sunrise is a day, or from full-moon to full-moon is a month. Changes in the seasons also remind us of the passage of time. There is a rhythm in nature. Spring follows winter and summer spring. When a cycle is completed we know that a certain amount of time has passed by.

(*b*) *Tenseness*. While long intervals of time are estimated

by change, very short intervals are estimated by the feeling of strain or tenseness that all of us are conscious of experiencing when we are eagerly looking forward to some event. We describe such a strain as the holding of our breath or poetically by the phrase "time stood still". The duration of this feeling of strain gives us a clue as to the length of time that has passed. A little strain means a few seconds, more strain means a longer period of time.

9. Experiments with Time

Scientists and philosophers have cast doubt upon the very existence of time and dramatists have taken liberties with it. One suggestion that has been made is that time is a continuous stream and what we call the past, present and future are merely arbitrary divisions that we make for the sake of convenience. What is past for some may be present for others. For example, since light travels only at a definite speed, it is possible that the inhabitants of some distant world with extra sharp vision may be now witnessing events which form our past. Another suggestion that has been made is that the past is all there still and that a person may find himself suddenly thrown back into it.

10. Aesthetic and Social Perception

How do we perceive beauty either in persons or things? Like the perception of space and time this is also the result of considerable education and experience. There are no standards of beauty acceptable to all. What is beauty to one may be the quintessence of ugliness to another. The perception of certain kinds of beauty is the result of careful training for many years. For example, the appreciation of classical music or art. It is quite possible to feel bored by a violin recital by Kreisler or be indifferent to the charms of Venus de Milo.

Social perception is the knack that we acquire of understanding the motives, intentions, intelligence and other qualities of people with whom we come into contact. This is a very important matter, for unless we do this we will not be able to adjust our conduct to meet the needs of the special circumstances that arise when people congregate. We will, for

example, smile at the man who is in gloomy mood and continuously say the right thing at the wrong time. Such tactless behaviour will not only make us unpopular members of society but also considerably impede our material prospects in this world.

But the thoughts and motives of persons are best known to themselves. How are others to understand them? Social perception like all other forms of perception is the result of a slow and lengthy training in reading meaning into signs. It is, of course, impossible for anyone to get a complete idea of another man's motives and character but all of us reveal by certain external signs something of our inner life. In our study of emotions we shall note that each emotion manifests itself in certain outward bodily signs. Anger, for example, is shown by the wrinkling of the brow, clenching of the fist, sweating, etc. Besides these external manifestations common to all, each man has got his own little system of signs by which he gives to others some clue for judging his inner life of thought, feeling and emotion. These systems of personal signs peculiar to each one are known as mannerisms. Some of us, for example, when nervous or irritated begin to bite our nails, others finger our coat buttons and so on. Thus, by carefully observing each man, noting his mannerisms and facial expressions we may be able in course of time to acquire some fixed data for perceiving his internal motives and character. A single sign may often reveal to us the complete mood of a man. Such lightning perceptions are often the result of considerable practice and intimate contact with the person concerned.

11. Illusions

An illusion is a false perception; it is responding to a stimulus by perceiving something that is not there; it is attaching a wrong meaning to a sign. The term illusion is generally used to indicate, not the private or individual mistakes made by people in perceiving things, but certain general tendencies that all of us seem to possess towards the wrong perception of certain type of objects. A good example of a simple illusion is seeing a rope in the dark and mistaking it for a snake. This is a mistake that anyone can commit, it is not something

peculiar to any particular individual or group of people. The robber running away from the scene of his nocturnal adventure mistakes every lamp-post that he sees for a policeman.

There are four types of illusions:

(1) *Illusions due to the peculiarity of sense-organs.* Our senses are so made that in certain cases they have a tendency to see things that are not there. When after looking at a piece of green paper for some time we turn our attention to a piece of red paper, the red appears redder than it really is. This additional redness is an illusion due to the peculiarity of our eyes. The cones of the retina get fatigued for a colour after some time and have a tendency to see its opposite before retinal equilibrium is restored. Another example can be taken from the sense of taste. If we drink a well-sweetened cup of coffee immediately after eating something sweet, it does not taste as sweet as it really ought to. We at once recognize this lack of sweetness as an illusion and make no attempt to add extra sugar.

(2) *Illusions due to preparatory set.* When we are anxiously expecting something we tend to mistake other things that resemble it, for the thing itself. When you have lost a silver coin every round little object looks to you like that coin. You are mentally prepared for the reception of a certain type of sensation and all those sensations that resemble this sensation have an advantage over the others.

(3) *Illusions due to false cues.* These are very similar to the previous set of illusions only here there is no preparatory set. One thing is mistaken for another because the two resemble each other very much. We generally recognize objects in a hurry, not by carefully studying all the sensations that come from them but just glancing at one part and mentally filling in the gaps. If the part of an object that happens to catch our attention is exactly like the part of another but different object, then the one may be mistaken for the other. Illusions of this type most commonly occur in reading. When we read we do not usually look at every letter in a word before we start pronouncing it. We just look at the first few letters and then mentally make up the rest. Very often our guesses come off correctly because they are based on the nature of the context.

But when dealing with an unusual word which resembles a well-known word we almost invariably succumb to the effects of this illusion.

(4) *Illusions due to the improper isolation of the fact to be perceived.* Sensations come to us in groups. Out of these combinations we pick out one and perceive it. But it is not always possible for us to isolate the sensation we want and perceive it as apart from its background. This incapacity of the mind gives rise to certain illusions. For example, it is often difficult for us to separate height from breadth. This is the reason why a fat man appears shorter than he really is or a thin man taller. Architects sometimes make good use of this illusion in the construction of buildings. If they want a building to appear taller than it really is, a number of thin long pillars are put in. Another example of the same phenomenon, used a good deal in laboratories, is what is known as the "size-weight" illusion. The same weight, say 10 ozs., is put in two cardboard boxes, one big and the other very small. The subject is asked to take one box in each hand and judge which box is heavier. He invariably says the smaller one is heavier, because being unable to isolate size from weight he unconsciously presumes that the bigger the box the heavier it must be, and therefore puts out a greater effort to lift it. In comparison with the effort made the smaller box then seems the heavier.

12. Illusion and Information

Do the presence of these illusions that we have been studying constitute a danger to the accuracy of the knowledge we get of the external world? We get such knowledge through our senses and the presence of illusions show that the senses are not always reliable. Does this not place the whole structure of our knowledge on a precarious foundation? The answer to these questions is on the whole in the negative. We recognize these illusions as such and discount them. Besides their number is so small that they do not constitute a serious menace to our knowledge. They have a considerable amount of nuisance value, they often lead us into making silly and sometimes irritating mistakes, but as sources of serious danger their influence is negligible.

Yet their very existence should create in us a spirit of humility. We can no longer be absolutely certain about the information that our senses give us. There is always the possibility of error. Sensations become definitely suspect. We need not be discouraged about the capacity of sensations to give us truth, but we must develop a spirit of caution. We need not go to the extreme of saying that the world is an illusion but we must also avoid the other extreme of saying "it is true because my eyes have seen it".

CHAPTER VIII

CONCEPTION—THE PROCESS OF THINKING

1. What is a Concept?

A concept is a general idea. Putting together several precepts we get an idea which represents the characteristic features of an object as revealed in all these perceptions. Experience is individual and piecemeal. Ideas come and go. If we have to keep each one of these ideas separate then our mind will soon be cluttered up with an unwieldy mass. Conception is the means by which we reduce the number of our ideas by putting those of a similar nature together and deducing a common principle out of them. We then forget the individual cases and remember the common principle. For example we come across men in different countries, in different grades of society and under a variety of circumstances. Putting all our ideas of man together we form a general picture of him, that he is of a certain range of height, build, etc., that he has certain characteristic features, that he is rational and so on. This is our concept of man. Each man's concept of his fellow beings will naturally differ according to the types of contact he has had with others.

Our concept of man was based on our *experience* and also upon our *memory*, for we did not see all the men on whom our concept was based at the same time. Our experience stretched over a period of time and when finally the concept was made our past and present experiences were pressed into service. A concept "stands for a concise formulation of all our knowledge on a particular subject". It is thinking of a universal or general principle as apart from its particular manifestations.

The concept represents the highest stage in the process of acquiring knowledge. After attending to sensations and understanding their meaning, we put several meanings together and

get a general meaning which represents the common element in the various particular meanings. Animals certainly attend to sensations, perhaps they even perceive the meaning of certain sensations,[1] but it is extremely doubtful whether they possess the power to form concepts. This is a peculiarly human quality, the result of man's rationality. It is the use of this quality that has made civilization and scientific progress possible. Even primitive man was lacking in conceptual ability. He tended to keep his various experiences separate, never suspected the presence of common factors in them and never thought of drawing general conclusions based on his experience. For example if A, B and C drank water out of the same well, fell ill and died, he just thought that three people had died. He never attempted to link up these deaths with a common source of infection. When at last he learned to do so the science of medicine was born.

2. The General Nature of Thinking

In the process of forming concepts we come across thinking in its highest form. Of course without thought no mental activity is possible. There is a science which studies in detail the various types of thinking and the various means of forming concepts—logic. Psychology is also interested in thought. Since it studies mental life, it cannot afford to ignore such an important aspect of the mind as thinking.

Man is a rational animal and some of his greatest achievements are to be found in the realm of thought—art, music, drama, science and philosophy. To the psychologist thinking is a form of behaviour and he tries to fit it into the general pattern of stimulus and response, that is characteristic of all behaviour. One of the interesting lines of investigation that the psychologist has started about thought processes is an answer to the question, is our thinking always accompanied by mental images? When we think about a cow do we always have a picture of the cow in our mind or the printed word "cow" or some other mental image. It is generally believed that we do. The French psychologist Binet discovered that one of his daughters did not have any mental images when she

[1] Köhler thinks that animals are capable of simple perceptions.

thought. He started the great imageless thought controversy which is still going on. Whatever the outcome of this controversy may be, it illustrates the fact that thought need not as such be relegated to the logician or philosopher.

3. Thinking a Trial and Error Process

If thinking is a kind of behaviour then it must manifest all those features that are characteristic of behaviour in the physiological realm. One of the chief features of human behaviour is trial and error. Both men and animals when presented with a new problem invariably try to solve it by the trial and error method, i.e. they go on trying one solution after the other until accidentally they hit upon the right method. There is a good deal of trial and error in our thinking also. Give a man a mechanical puzzle and note how he behaves. He goes on fiddling with it. It is obvious that he is indulging in a good deal of trial and error thinking. Whereas in other forms of behaviour he acts out the various solutions here he goes over them mentally. Then he picks out the most likely solutions and tries them out—this is really what he is doing when he appears to be fiddling. When faced with a new problem the solution does not come to us ready made. We have to think out various possibilities and then actually try out the most likely ones until we are successful.

4. Thinking Involves Analysis and Reorganization

Analysis is the means by which we try to simplify a complicated problem. The problem is broken up into bits and each bit understood separately. Analysis is a device which we employ in all forms of behaviour and is used a good deal in thinking also. How does a man understand the mechanism of a watch? By opening it at the back and taking out the various wheels and springs. He behaves in exactly the same way when faced with a complicated mental problem, say the understanding of a difficult passage in a book. He tries to solve the difficulty by splitting up the passage into as many small bits as possible and trying to understand each bit separately.

It is no use pulling a watch to pieces unless you are able to put it together again; for otherwise your work will be

destructive rather than analytical. Similarly when you have understood the significance of the different bits of the passage in the book separately, you must put it together and then try to understand the passage as a whole. Analysed material is always reorganized.

5. Thinking Results in Insight

As one thinks about a given problem, suddenly a new light is thrown on the matter which makes its understanding easy. Trial and error thinking paves the way for *insight* as this new light is called. A mathematician may worry over a problem which baffles him at first. He tries one solution after another tentatively, but sees no way towards a solution. He may even give up the problem and attend to some other business when suddenly the solution comes to him in a flash as it were. His preliminary researches were not wasted, they paved the way which eventually made an insightful solution possible. Insight represents a fairly high level of thinking. Köhler found that apes were capable of simple insight solutions.[1]

6. Reasoning

Here at last we come to something that is peculiar to man—the power to reason. It is this capacity to reason that enables us to form concepts. In a concept we put several particulars together and try to reason out the common element in them. Logicians generally recognize two forms of reasoning, deductive and inductive.

Deductive reasoning is expressed through the syllogism where a particular idea is brought under a general idea and a new truth inferred from it. For example:

All men are mortal
Socrates is a man
Therefore Socrates is mortal.

Here the particular idea "Socrates is a man" is brought under the general idea "all men are mortal" and a new truth "Socrates is mortal" inferred from it. Whereas in deduction we go from

[1]Children also while playing with constructional toys often reveal flashes of insight.

the general to the particular in induction we go from particular to general. Putting several particular instances of a phenomenon together we draw out or infer a general principle from it. Seeing A, B, C and E die we infer the general principle that all men are mortal. The concept "man" itself is the result of our putting together all our knowledge of particular men and then getting a general idea of their characteristics out of it. Induction is the most generally used method of forming concepts.

7. Autistic Thinking

All the examples of thinking that we have considered so far are cases of thinking with a purpose; we had either a problem to solve or a general principle to infer. But thinking is not always purposive in nature. Sometimes we think for fun without any particular aim in view. We are lost in a train of ideas which seem to us pleasing for the time being though we are fully aware that they have no practical value or connection with reality. For example you may sit and think what you will do if you win the first prize in a lottery. Speculation along this line is highly pleasing though you know for certain that the chances of winning the prize in question are extremely remote. Such kind of thinking is a kind of play activity. It is autistic or indulged in for its own sake.

Another way in which we may indulge in autistic thinking is to cling on to our pet theories even though we know full well that they are false. Such clinging gives us a certain amount of personal pleasure, irrespective of the fact of their objective validity. Murphy suggests that this is the reason why we cling to certain beliefs even though they have long ago been conclusively proved to be false.

CHAPTER IX

LEARNING

1. What is Learning

All human activity can be divided into two groups—inherited and learned. Reflexes and instincts are examples of inherited activity, but the way in which we use these is a matter of learning. Native reactions are modified by experience and training. The instincts of the adult are quite the same as the instincts of the child, yet he fulfils them in a different way to that of the child. He has learned these new reactions. The basis of action is instinctive, the mode of action is learned or acquired.

Learning is the process of modifying our activity through experience, or to put it very roughly the process of acquiring the knack of doing things. This is a process that is continuously going on in all human beings and animals. We live and learn and as long as we live we learn.

Of all the processes investigated by the psychologist learning is perhaps the one most susceptible to experimental treatment. Consequently a large body of experimental data is available on the subject.

This is one of the topics where the study of the animal and the child has helped us a good deal. Here the genetic method is the most profitable one to follow, and to find out the simplest forms of learning we have to go to the animal and the child. The adult brings to the learning of any new task a certain amount of experience, the result of previous learnings. He does not start from scratch as it were. But when a child or an animal is confronted with a new task, it starts with a clean sheet. The way in which it sets about to accomplish the task gives us an insight into the learning process in all its purity. In the case of animal experiments, the subject is brought to the laboratory and is given a simple but specific task to perform. The time it takes to achieve the goal in successive attempts, the speed with which it eliminates use-

less movements (movements irrelevant or obstructive to the achievement of the goal) are all noted carefully.

Psychologists have used two devices extensively in experimenting with animals—the maze and the puzzle-box. The maze is a series of passages with but only one way out. Different types of mazes can be made to suit the size and capacity of different kinds of animals. Learning a maze consists of learning to avoid blind alleys. At first the animal takes every turning that comes its way, and thus wastes a good deal of time. Then one by one it eliminates the blind alleys and the correct route is slowly fixated in its mind. As this happens the time taken to get out of the maze decreases till at last it walks out without making a single mistake. The time taken at each successive attempt gives us a convenient quantitative means of measuring the progress of the learning process.

While the maze is convenient for measuring the speed of the learning process, the puzzle-box helps us to get an insight into the nature of the process itself. The puzzle-box has also only one way out, usually by a door which is operated by a fairly conspicuous device like a latch or a knob. The box is made up of some kind of lattice work so that the antics of the animal inside can be observed by other animals and the experimenter. The problem to be learnt consists of locating the means of exit, manipulating the knob or latch and coming out. The reactions of the animal are carefully watched. How long does it take to find the door? How does it proceed in the beginning? Has it any plan of action or does it merely dash about on all sides of the box till by accident it hits the releasing knob? In its second and succeeding attempts does it profit by experience? Do other animals who watch from the outside profit by its mistakes when their turn comes? Such and other similar questions having an important bearing on the learning process can be studied by means of these experiments.

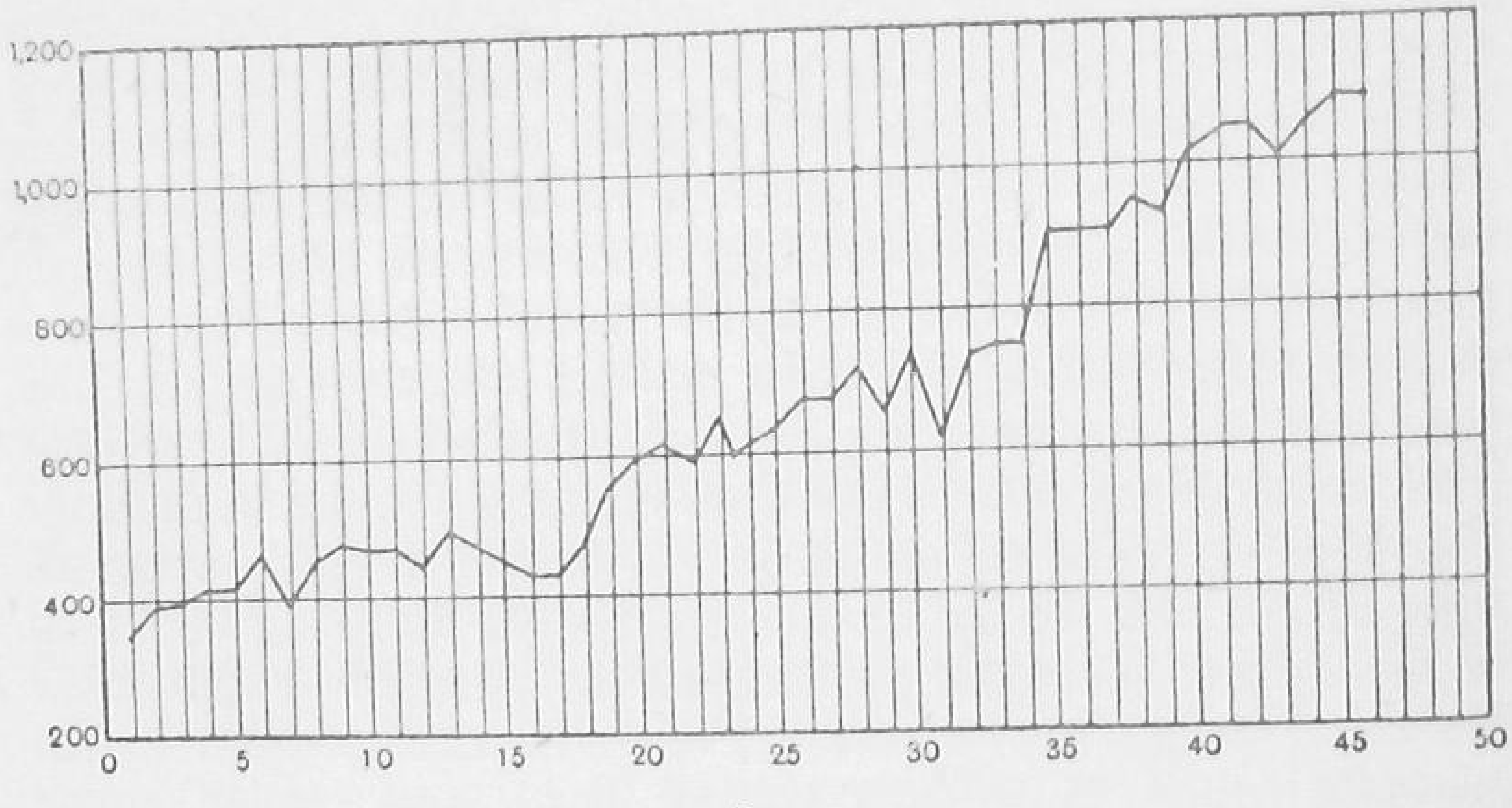
2. The Curve of Learning

The rate at which we learn differs from individual to individual and is dependent to some extent on the nature of the task attempted. In certain complex cases, like sending out telegraphic messages, the curve of learning may be represented

by a single broad sweep which flattens out towards the end. This means that the rate of progress is steady and continuous until a certain degree of efficiency is reached. In other activities the curve may be represented by a zig-zag line indicating two periods of quick learning with a period of no learning in between. Such a flat period coming in the middle of the learning process is known as the *plateau*. This is the time when people get discouraged with their efforts and often give up the attempt in disgust. But those who persist through the plateau, find suddenly that they have started making improvement once again. (*See* diagram below.)

3. Trial and Error

Thorndike has performed many experiments to study the nature of animal learning. He made extensive use of the puzzle-box in his experiments. His subjects were mostly cats. What does the cat do when put inside the puzzle-box? It



Individual Curve of Practice in Simple Addition—Kraepelin Sheets. (From J. C. Flugel's "Practice, Fatigue and Oscillation" by kind permission of the Cambridge University Press.)

immediately begins to dash itself frantically on all sides of the box till at last quite accidentally, it hits the knob that opens the door and then comes out. When put in again it repeats the procedure but the time it takes to find the knob is lessened. At every successive attempt the time decreases till at last after

several attempts it learns to master it. After this whenever it is put into the puzzle-box it goes up to the door immediately presses the knob and comes out. The cat has learned to perform a new kind of activity through trial and error. This is the most common way in which animals learn, but the method is by no means restricted to them. A good deal of human behaviour is also the result of pure trial and error. Though we are superior to the animal in possessing a reasoning faculty yet we do not always use it. Often when faced with a new problem, like the animal, we blunder about till accidentally we hit on the correct solution. It is quite common for us to acquire the knack of doing a thing without understanding the reason that governs the actions of that thing. We can learn to drive a car without knowing anything about its mechanism.

The trial and error method consists of activity repeated time after time with the gradual elimination of the unsuccessful response and the gradual fixation of the successful one. The unsuccessful responses are eliminated very quickly if there is some kind of punishment following every such response. For example a rat learns the right way in a maze much more quickly than it otherwise would if it receives an electric shock after every wrong turn that it takes.

Thorndike's theory has, however, come in for a certain amount of adverse criticism. Some critics ask the question—Does the animal when faced with a new situation merely make a series of random movements as Thorndike claims? They point out that this does not seem to be the case unless the animal is badly frightened and is in a panic. It is much more likely, suggests Russell, that when confronted with a new problem the animal from the beginning tries to solve it. Its efforts may be at first ill-directed and from the human point of view clumsy. But it persists and varies its methods until a solution is reached. Krechevsky is of the opinion that animal learning is from the beginning a series of organized attempts at a solution. McDougall and Lashley confirm this view. All three experimenters used rats in their experiments.

4. Imitation

Imitation stands next to trial and error in the scale of

values in the learning process. It is not so mechanical as trial and error but is inferior to learning by observation or insight. By imitation we mean the capacity to perceive the details of an action and to follow it without being aware of the reasons on which such action is based. It is mechanical in nature and is the result of suggestion. In suggestion we accept a statement without any rational ground for doing so. We merely follow somebody else's plan of action, without having the least idea of why he is acting in the way he does.

Can animals learn by imitation? The evidence so far obtained seems to show that cats cannot. While one cat was learning to master the puzzle-box another cat was made to sit outside and watch the procedure. Then when the first cat had learnt to open the door and come out, the second one was put into the puzzle-box. Thereupon it behaved as though it had not observed the first cat at all. There was not the least sign of having profited by the first cat's experience. Tradition has, however, endowed the monkey with an abnormal amount of the power of imitation. Psychological experiments have supported this traditional view. Köhler's experiments with chimpanzees show beyond all doubt that they can learn by imitation.

5. Observation

Trial and error as well as imitation involves a certain amount of observation. In trial and error one slowly observes what kind of action precedes the successful result and how this differs from the unsuccessful types of action. So the belief held by some people that animals cannot learn by observation is not true. If they can learn by imitation or by trial and error we must grant them at least rudimentary powers of observation. Though both these processes involve observation, yet learning by observation proper is a higher type of activity. In imitation we merely observe the actions of another as he tries to solve a problem. In observation we attack the problem directly. This direct approach to a given problem represents a very high type of learning and is only second to insight learning from the point of view of the amount of grasp you have over a problem.

Certain animals are capable of even this higher type of

observational learning. But naturally even their direct observation is of a rudimentary type. Among the lower orders we find that the material observed is only retained for a very short time. The following experiment shows that white mice can observe. Three boxes are arranged in a row, each having an electric light on top. Food is placed in one particular box, but always the light over the box containing the food is switched on. A white mouse is kept at a distance from the row of boxes and released as soon as the light is switched on. At first the mouse goes indiscriminately to any box it likes and failing to find food there explores the other boxes. But soon it connects the light with the food and goes straight to the box where the food is. But suppose the light is switched on and off again and the mouse is released a few minutes after the light has been switched off, it becomes utterly confused and does not know which box to go to. White mice can retain the material observed only for a few seconds. But monkeys can retain observed material even for hours. Of course the animal's powers of observation cannot be compared with the human either in complexity or permanence.

6. The Conditioned Reflex

This is the discovery of the Russian neurologist, Pavlov. It has made an important contribution to our knowledge of the learning process and has had considerable effect on general educational theory as well as the technique of character building.

As with most great discoveries, the principle behind the conditioned reflex sounds very simple when formulated. A natural reaction, which originally belonged to a natural stimulus, may be linked on to an artificial stimulus so that after some time the artificial stimulus brings on the natural reaction just in the same way as the natural stimulus did originally. This process of linking up the natural reaction with an artificial stimulus is known as *conditioning*. The original situation in which this process of conditioning was discovered was the famous "dog-food-bell" incident which happened in Pavlov's laboratory. The central figure was the dog.[1] It so happened

[1]Dogs and many other animals have played a truly heroic part in the development of psychological knowledge.

that a bell was being rung a few minutes before its food was brought in by the laboratory assistant. This happened regularly. The bell, of course, had nothing to do with the dog's dinner, but accidentally the two coincided. Now Pavlov one day noted that the dog's mouth began to water as soon as the bell was rung though as yet no food was in sight (there was, of course, a short interval between the bell and the food). With the insight of a genius, Pavlov at once seized upon the significance of this almost trivial incident. Now saliva in the mouth is the natural reaction to the natural stimuli sight of food or food in the mouth. Pavlov at once saw that what had happened was that the constant occurrence of the bell-food situation had made the dog connect food with the bell so that the mere ringing of the bell was enough to produce in it all the natural reactions generally connected with food. A process of conditioning had taken place in the dog—the natural salivary reaction had become linked to the artificial stimulus bell.

7. Variations and Modifications of the Conditioned Reflex

Once the initial fact of conditioning was established Pavlov introduced a number of refinements into the original situation in order to eliminate any irrelevant phenomenon. Lest the appearance of the attendant bringing in the food may introduce an unnecessary factor into the situation, a mechanical device was invented by which the plate containing the dog's dinner reached it without any human aid. The dog was placed in a sound-proof chamber so that only those sounds that the experimenter intended that the dog should hear would reach it. Lest particles of food sticking in the dog's mouth cause the salivary reaction, its mouth was cleaned regularly. By these and various other precautions and devices the conditions affecting the situation were completely controlled and new and more systematic experiments were carried out. As a result of all this work the following facts about the conditioned reflex were established:

(*a*) In the beginning the artificial stimulus has no effect on the individual. It is only when the artificial stimulus is repeated several times in combination with the natural stimulus

that the reaction gets switched on to it. The dog was at first completely indifferent to the sound of the bell; there was no salivary reaction. It was only when the bell was followed by food several times that the conditioning took place. The repetition of the artificial stimulus in combination with the natural stimulus is an important matter.

(*b*) In the initial stages when the conditioning is just being established, the artificial stimulus does not bring out the natural reaction in its fullest form. The reaction is apt to be feeble and tentative. Even after the dog had been conditioned to the bell the flow of saliva brought about by the ringing of the bell was in the beginning much less than what was brought about by the actual presence of the food.[1] The amount of saliva brought about by the bell, however, increased progressively till at last sound became as good a stimulus as sight or smell.

(*c*) The conditioned reflex is not so deep-seated in the organism as a natural reflex. It can be easily made to wear out. If the artificial stimulus is not followed by the natural stimulus, after a time it ceases to have any effect at all. Once the conditioned reflex has been forgotten it cannot be re-established very easily. The subject has to be kept in constant training.

(*d*) When a conditioned reflex is in the process of being established, reactions that resemble the artificial stimulus may also have the effect of bringing on the natural reaction, but once it has been established only the original artificial stimulus that was combined with the natural stimulus and no other will bring it on. In the case of the dog when the linkage between the bell and the food was being established the beating of a drum which gave out a roughly similar sound to that of the bell brought out the salivary reaction. But when once the reflex was established, only the bell and no other type of sound could bring it on.

(*e*) The initial stage of conditioning (i.e. when a linkage to an artificial stimulus has been established but has not yet sunk into the system) is the most critical time for its well-

[1]As a crowning indignity a hole was made in the dog's cheek and a rubber tube put in so that the actual amount of saliva given out at various times could be measured.

being. It is at this stage that the newly established reflex requires careful nursing as it is most susceptible to the adverse effects of distraction. A conditioned reflex may be totally inhibited by a distraction. If when the dog was learning to connect food with the bell, there had been a big explosion in the neighbourhood, the whole process would have come to an end and the experiment would have to be started over again. A distraction need not, however, be of a violent kind. Anything that takes the dog's mind away from the bell-food situation, say the presence of a rat, can be counted as a distraction. For human beings the distraction may be internal, sometimes purely mental like an idea (doubt or disbelief).

When the conditioned reflex is almost forgotten it makes a sudden and dramatic reappearance if the artificial stimulus is given along with a powerful distraction. When the dog, for example, had nearly forgotten to make the salivary response at the sound of the bell, it came back in all its original intensity when along with the bell a trumpet was blown loudly.

(*f*) It was also found that certain conditions were favourable to the establishment of the conditioned reflex. As we have already noted the timing of the artificial stimulus is an important matter. In the earlier stages it must be very closely associated with the natural stimulus and the combination repeated as often as possible. Being a reflex it is as much dependent on the nervous system as any other reflex. The nervous system must be functioning at its usual pitch of activity and the subject must be fully alive, active and alert. The artificial stimulus must be moderately intense to achieve the best results. If it is too feeble, it may be unnoticed; if it is too strong it may defeat its own purpose. In the case of the dog it was found that too intense a stimulus merely annoyed the animal. It is also advantageous to keep up a certain plan or rhythm in giving the combination of stimuli. The experiment must be conducted in a place where all distractions are excluded (for example, in a sound-proof chamber).

8. The Conditioned Reflex in Human Beings

Human activity being much more complex than the animal, the establishment of conditioned reflexes in man is relatively

more difficult. Activities run into each other, responses get mixed up, hence we cannot hope to get clear-cut results. All the same a good deal of conditioning does take place in man, as he goes through the varying experiences of daily life. We may take one such case of conditioning in man. The psychologist, Watson, has shown that a good deal of human fear is nothing but a conditioned reflex. He performed a simple experiment which illustrates very well how we become conditioned to fear. A child was playing with a rabbit—a pet whom he obviously loved. As he was stroking its fur the experimenter made a fearful noise with a trumpet. The child at once recoiled with fear. The next day the child began to show symptoms of fear at the very sight of the rabbit. The fear response connected with the terrible noise was linked up with the innocent rabbit and henceforth the animal evoked only fear reactions.

9. The Power of the Conditioned Reflex

Starting as a laboratory experiment, the conditioned reflex soon outgrew the limitations of its academic origin. People were not slow to discover its significance for the education of public opinion and for character building. The conditioned reflex tells us that we can make man's behaviour follow any fixed pattern that we want it to, provided we start conditioning him in the right way. In Watson's experiment we saw that a child was made to fear an innocent object because it is linked with another object that it was already frightened of. Similarly a child may be made to obey absolutely any person's authority, provided that this was linked up with the authority of someone whom he naturally obeyed. In this way all man's reactions can be moulded to suit any particular person's needs, provided he is able to get proper facilities to condition them. Infancy and early youth is the best time for conditioning and it has been claimed that a man who has absolute authority over the primary schools of a country for four years can establish his power over that country for the rest of his life.

10. Negative Adaptation

We can learn to cultivate a habit of inattention to certain

distracting stimuli. To this type of learning the name of negative adaptation has been given. A distraction is a stimulus that attracts our attention away from a thing to which we mean to attend. There are so many distractions in this world around us, that had it not been for our capacity to learn how to form negative adaptations, concentration on any given job would be almost impossible.

11. Insight Learning

This is the most advanced form of learning. The trial and error element is entirely absent here. The complete solution makes its appearance suddenly. It is based on an understanding of the whole lay-out of the field, in which the problem to be learnt, occurs. It is "a grasping of the essential relations, temporal, spatial and causal of the situation to be learnt." The solution not only comes suddenly but is put into action as one continuous unhesitating process.

12. Animal Learning

While studying the different types of learning, we referred repeatedly to the animal. We saw that trial and error is the most common method of learning among animals. Certain animals can also learn by imitation and observation. The various maze experiments performed with animals indicate that the quickest thing that an animal can learn is a sense of location. The conditioned reflex was first discovered in a dog and most animals are capable of forming negative adaptations.

Our knowledge of the nature of animal learning is based on the researches of such well-known psychologists as Lloyd Morgan, Köhler, Yerkes, Thorndike and Pavlov. It is safe to start the study of learning in animals with the principle that as far as posssible, one must abstain from attributing reasoning powers to them. In the words of Lloyd Morgan, "In no case may we interpret an action as the outcome of a higher psychical faculty, if it can be interpreted as the outcome of the exercise of one, which stands lower in the psychical scale." This dictum has had the desirable effect of giving psychological experiments with animals a healthy start. It turned people's attention away from anecdotes of animal intelligence. The psychologist started

with no preconceived ideas about the nature of animal intelligence.

Do animals learn by insight? Köhler's experiments with chimpanzees throw a good deal of light on this question. A serious defect in Thorndike's work was that his experiments were all conducted inside the laboratory. It was pointed out by critics that the problems he set were artificial in nature and too difficult and complicated for the animal to grasp. Köhler therefore devised very simple problems for his chimpanzees. The principle underlying his experiments he describes thus—the experimenter sets up a situation in which the direct path to the goal is blocked, but a roundabout way is open. The animal is introduced to the situation. The means by which the goal may be reached are all placed before it. The behaviour that the animal then adopts is watched carefully.

One of the simplest tests employed by Köhler was this—a bunch of fruits was placed outside the bars of a cage beyond the reach of the animal, leaving one or two sticks inside the cage. This was first tried on an adult chimpanzee called Tschego, who to begin with paid no attention to the sticks but tried to get at the fruit with her hands, and then gave up the task as hopeless. After some time, some younger chimpanzees outside came near the cage. Suddenly Tschego seized a stick and pulled the fruit, cleverly placing the stick on the foreside of the fruit, so as to hook it in. During the course of these experiments an interesting thing happened. If there were no sticks available, all sorts of objects, straws, pieces of string, wire and so on were used as substitutes for the stick. "Any movable object seems to have acquired the functional value of a stick."

In other experiments the apes and chimpanzees performed more complicated feats. Sticks were fitted one into another to make them long enough, boxes were piled on one another to make them high enough. No doubt their attempts were crude and clumsy, at the same time they were spontaneous and deliberate. Köhler thinks that the apes and chimpanzees showed real insight, for there were little signs of trial and error, the solutions making their appearance in a more or less com-

plete form, indicating that the animal had in some way grasped the essentials of the problem and seen a way to its solution.

13. Habit

Habit bears the same relation to learning, as the secondary automatic reaction does to the reflex. Habit is a learned activity that has become almost automatic. Much of the task of parents and educationalists consists of instilling into children certain habits, which would be useful to them throughout life. There is a popular belief that good habits are difficult to form and easy to break, whereas bad habits are easy to form and difficult to break. There is no psychological evidence to support this theory. For our purposes, all habits are on the same level. The moral distinction, though of great importance, falls outside our province.

We have the capacity to form habits because we have a nervous system that has a slow growth and a great capacity for modification. During the period of growth, new ways of action impress themselves on the system and in course of time become a part of it. We have a "structure weak enough to yield to an influence but strong enough not to yield at once." Habit, however, is not peculiar to man or animal. It is primarily a problem in physics. A garment that has once been used fits the body better than a new one; it is easier to fold a piece of paper along a crease than at a new place.

Habit simplifies the movements required to achieve a given result, makes them more accurate and diminishes fatigue. It also diminishes the amount of conscious attention that we give to any act. When we are beginning to learn a new task we throw all our conscious energy into it, for example, a child learning to write. But when once writing becomes habitual, one can write and speak at the same time. Habits are also of considerable social importance. A man without habits would be a very difficult man to deal with, but when we know a man's habits, we can roughly calculate his probable course of action, at a given time or under given circumstances. Besides stabilizing social relationships, habit also enables people to carry on with jobs which are at first sight unpleasant or unattractive. The lighthouse keeper, though cut off from all

human contacts, carries on with his lonely but important work because he becomes habituated to it.

14. Habit Formation

Childhood is the best time to form habits. This is the time when our nervous system is most plastic and hence easily susceptible to new influences. All personal habits must be formed before one reaches his twentieth year, e.g. habits of cleanliness, pronunciation, gesture, etc. The time to form intellectual and professional habits is between twenty and thirty years. After this a man's life becomes set as it were.

The following hints[1] may be of some use in forming habits:

(1) Make a vigorous and wholehearted beginning. A half-hearted attempt to form a new habit is doomed to failure almost from the start. Make as many allies as possible. Tell all your friends about the new resolution that you have made so that the publicity may prevent you later from going back on it. Bring your mastery instinct into play. Once you have announced that you are going to do something and then fail to do it, people will look down upon you as a weak-willed person. A system of rewards and punishments is often of some help in strengthening a wavering resolution.

(2) Never allow exceptions to occur until the habit is well rooted in you. Exceptions are the greatest danger to a habit when it is in the process of being formed. A single exception may often undo the fruit of a week or a month's struggle and set you back where you began.

(3) Make use of all possible opportunities. We all have certain moments of spiritual exaltation when we are inclined to make resolutions which we dread making in ordinary times. It may be the result of hearing a famous preacher, reading a moving book, or experiencing some other unusual incident. Such moments should be made use of to take the plunge. Strike while the iron is hot and let everybody know that you have struck.

[1]These, as well as most of my material in the previous section, are taken from William James's classic chapter on the subject in his *Principles of Psychology*.

15. A Theory of Learning

Learning is the modification of behaviour as a result of experience. The man who does not learn is generally the man who does not profit by experience. The process of learning has also been described as "fixation growing out of restlessness". We are restless in the sense that we are always making tentative responses to a number of new stimuli. Out of these tentative, exploratory responses there grow certain fixed habits, signifying that some of these responses have been well learnt, while others have been rejected. Why should certain responses be selected and learnt while others are rejected? One factor that determines the selection is to be found in our general interests, the background of our behaviour patterns, existing at the time that the selection is made. Another factor is motivation. Why does the cat in the puzzle-box spend so much energy in the task of learning to open the door? Because it is hungry and there is food outside. A well-fed cat is not in a great hurry to learn the same trick.

Another way of looking at the process of learning is from the point of view of what is happening in the nervous system. Every new act of learning represents the formation of a new pathway in the nervous system. At any given moment nervous energy may flow along several possible routes. Out of these, one is chosen, when we learn a particular act, either because of our strong motivation in that direction, or because the other routes happen to be temporarily blocked up. Once nervous energy has flown along a particular route, it has the tendency to take the same route the next time the same situation occurs. Soon that particular pathway is firmly established.

CHAPTER X

MEMORY

1. What is Memory?

Memory is a word with a wide meaning. We are apt to think of remembering as a single process but it is really made up of four different activities. These are: (1) Learning or memorizing proper, (2) Retention, (3) Recall, (4) Recognition. We shall take up each one of these processes separately.

2. Learning or Memorizing Proper[1]

This is the first stage in the process of memorizing. To remember, for example, a poem the first thing you have to do is to *learn* it, or get it by heart. What are the ideal conditions under which a man can learn or memorize a given passage? This practical question has been the subject of a good deal of experimental work by psychologists. Among these the name of Ebbinghaus stands out as that of a pioneer. To him goes the credit of overcoming a practical difficulty connected with memory experiments. Suppose we take four people and give them a passage to memorize, how are we to be sure that they all come to the task with the same background or that one or other has not got an unfair advantage over the rest? If the passage happens to be an historical one, it is quite possible that one of the four is a student of history and so the material is more familiar to him than to the others. If he learns the passage quicker than the others it is not because he has a better technique, but because he has an initial advantage. How can we be sure that all our subjects start from scratch as it were? How can we find material for memorizing which would mean exactly the same thing to all the subjects taking part in the experiment? Ebbinghaus provided a solution

[1]I wish to express my indebtedness to R. S. Woodworth's "Psychology" for the general plan and much of the material in this chapter.

to this problem by inventing the nonsense syllable—two consonants with a vowel in between, e.g. WEQ, YIX, KOZ. Such nonsense syllables are equally meaningless to all and hence we can be fairly certain of all our subjects getting an equal start. Experiments concerning this aspect of memory have mainly centred round two questions—the relative merits of spaced and unspaced learning, part and whole learning.

3. Spaced *versus* Unspaced Learning

This is a matter over which there is considerable controversy even now. Experiments are still going on, the results obtained sometimes favouring spaced and sometimes unspaced learning. The balance seems to be now slowly turning in favour of spaced learning. It is more durable and more effective than unspaced learning. It is a common experience with students that continuous *cramming* before examinations may produce a certain amount of immediate mastery over material learnt, but the knowledge so gained evaporates soon after. If there are reasonable intervals between attempts at memorizing, the thing learnt gets better consolidated and stays with you longer.

4. Whole *versus* Part Learning

This also is a controversial matter, where data can be produced in support of either type. There is no doubt that part learning produces quick and dramatic results. But like unspaced learning, matter thus quickly memorized is forgotten equally quickly. Hearing anyone trying to memorize a poem by the part method, one cannot help but feel that it is highly mechanical. If one reads the whole poem several times, he gets some idea of the general plan of the poem and details can be fitted in without any undue sense of strain. It cannot be very pleasant to anyone to repeat the first line or two of a poem fifty times until he knows it by heart. On the other hand, repeating the whole poem fifty times may not be so wearisome, as one gets a chance to appreciate the general beauty of the poem. Events follow in a logical sequence. These things rob repetition of some of its monotony. The man who has memorized according to the part method will find himself completely stranded if there is a breakdown at the time when

he wants to recall the material memorized. Since every sentence stands by itself in rigid isolation, when a particular sentence is forgotten, there is no subsidiary help to his memory. But the man who learns by the whole method, if he forgets a particular bit, has something to draw upon as an aid to his memory. Since he knows the general plot and has some idea of the sequence of events, he may try to remember that which is forgotten by the help of that which has gone before or that which comes after.

5. Four Factors Involved in Memorizing

The method we ought to adopt in any given act of memorizing should be dependent on the aim in view. If we are after quick results, part, unspaced learning is advisable; if we are after stability, the whole spaced method is to be recommended. We must note that there are four factors involved in memorizing and that some of these factors are in favour of one form of learning, and some in favour of another. These four factors are:

(*a*) *The factor of confidence*. This is in favour of part learning, where you get immediate results. Each line is mastered before you go on to the next, and as the number of such mastered lines mounts up, you know that the job is being finished bit by bit. You know exactly where you stand. Whereas in the whole method, you have to wait till the very end, and all the time you are kept in suspense as to how the end is going to be. After repeating a poem a hundred times you may find that you have not got even a single line and may feel that you have been wasting your time. This fear of ultimate results saps one's self-confidence, whereas the small but tangible success following the part method inspires it.

(*b*) *The factor of recency*. This is undoubtedly in favour of unspaced learning. Here there are no intervals between various repetitions. You strike while the iron is hot.

(*c*) *The factor of meaning, outline and broad relationships*. This factor, which is perhaps the most important of the four, is in favour of whole learning. Part learning, we have seen, is mechanical. In trying to master each line we lose sight of the general lay-out. The whole method undoubtedly gives an idea

of the meaning and outline of the material to be mastered.

(*d*) *The factor of consolidation through rest.* This factor is obviously in favour of spaced learning. Too many repetitions at a stretch of the same material is apt to fatigue the mind and make it unresponsive. Resting for some time after every few attempts gives the mind time for consolidating the material learnt and such consolidation helps to fix the material more permanently than otherwise.

6. The Will to Learn

Whatever method we may adopt in memorizing, a real interest in the material learnt and a genuine desire to master it is an important matter. Without this will to learn, we cannot hope to get the maximum results.

In a Swiss laboratory, during the course of some experiments on memory, the subjects were given a list of paired associates to learn by heart. They were told that when they were given one of the paired words they must respond by giving the other word in the pair. The subjects memorized the material and went through the test successfully. Then they were asked to write down the first word of each pair in the order in which it was originally given to them. Almost all the subjects broke down in this test. Although they knew the list horizontally, they did not know it vertically. Many said that the second test was unfair as they were not told previously that this was expected of them. The will to learn operated in the direction of the pairs. There was no will to learn the sequence of words, so it was not learnt, though considerable time was spent over the material as a whole.

The importance of the will to learn is brought home to us not only in laboratory experiments but in many incidents of daily life. Among other things it affects the reliability of testimony. People witnessing the same incident when questioned about details give varying and often contradictory reports. There is of course no deliberate attempt at deception, but each one is guided by his will to learn and observes only such aspects of the incident as interest him. When questioned about aspects that he did not observe, he makes up the details more or less unconsciously.

7. Unintentional Learning

Though intention is an important matter and does enter into all serious attempts at memorizing, there is a fair amount of unintentional learning also happening to us in our experience. We can and do learn things without desiring to do so. A "catchy tune" heard only once at a theatre sticks to our memory without our being aware of having made any effort to remember it. The teacher who calls out the roll every day soon knows by heart the list of students in his class, though he makes no deliberate attempt to memorize these names.

8. Recitation

Recitation is a useful ally in memorizing, and can often be profitably employed. Assuming that you are memorizing a passage by reading it silently, it is a good thing occasionally to recite aloud the material you are studying. This will tell you where exactly you stand and how much you learnt (and if this happens to be a fair amount, it has a stimulating effect). It will also tell you which are your weak points, the bits that you tend to falter over, so that you may pay extra attention to them. Above all reading aloud provides you with a double stimulus (sound as well as sight). One stimulus reinforces the other, and your results improve. It is no doubt true that recitation involves a certain amount of extra expenditure of energy, but the expense is well worth it.

9. Retention

Once you have successfully memorized a given passage you forget all about it until such time as you want it, when it comes back to you. Where was it staying in the interval? We say that it was *retained* in the mind, but how and where exactly did it stay? This is one of the big puzzles of psychology. Two views have been put forward in answer. Certain psychologists claim that memorized material is retained as modifications of the brain structure. There is nothing inherently absurd about this theory, but in the present state of our knowledge we do not seem to have enough evidence either to prove or disprove it. From the very nature of the case this is not a matter in which it is easy to get experimental evidence. The brain is

not available for microscopic examination after every act of memorizing, and even if available the changes it is claimed are so very minute that they will not be visible even through a microscope.

The second view is that it stays in the unconscious. The unconscious is our great mental reservoir, where it is claimed all the overflow of ideas from our conscious are stored. It is quite possible that memorized material stays in the unconscious and is brought back into the conscious whenever necessary.

10. Fixation and Consolidation

Though we are not quite certain how or where the material we learn is retained for subsequent use, it is obvious that retention is the crucial aspect of memory. Unfortunately, of all the memory processes retention is the least amenable to control.

Immediately after we have finished an act of memorizing there goes on in our mind a process which has been called fixation and consolidation. The material that has been memorized sinks into us, and assumes some kind of permanent form. What can we do to prevent our memory pictures from fading? One helpful factor is *rest*. Consolidation is favoured by rest and relaxation immediately after memorizing. Sleep is of course the best form of rest and some people have even gone to the length of advocating a nap after every act of memorizing. But most of us cannot go to sleep whenever we want to. The next best thing is to lie down and relax. Conversely, too strenuous exercise should not be indulged in immediately after memorizing, as this exertion interferes with the process of fixation and consolidation. An extreme instance of such physical exertion interfering with fixation is to be found in shock amnesia. Any violent shock brings about amnesia for the matter learnt immediately before. Woodworth gives the example of a boy who went out for a walk, climbed a tree, fell down on his head, and lost his consciousness. When he came to, he forgot all about having gone for a walk or climbing a tree.

11. Perseveration

Mental acts do not start and cease abruptly. There is some kind of a lag or shadow which persists even after the act is

finished. This is true even of material objects like a radio or an engine. The existence of this phenomenon, to which the name of perseveration has been given, was discovered by Neisser, the psychiatrist, in 1894. He describes it as the "abnormally persistent repetition or continuation of an activity after the activity has been once begun or recently completed". Spearman puts the same idea in a different way in his law of inertia—"Cognitive events both begin and cease more gradually than their (apparent) causes". The experiments of W. J. Pinard go to show that perseveration actually increases between the ages of eight and twelve while that of C. Rangachar, that Jewish children have more perseveration than English.

What light do these interesting facts about perseveration throw on the process of retention? If perseveration works itself out, the act of memorizing is completed, and there are greater chances of the memorized material being retained than by abruptly switching off from a task of memorizing to some other intellectual or manual work. It is a great help to the memory process to recognize the existence of perseveration and make allowance for it.

12. The Limits of Retention

Can anything once learnt be ever completely forgotten? Most of us will answer this question straightway in the affirmative. We do not remember many things that happened to us during our childhood, and our memory for even recent events cannot be said to be complete in any way. Yet if we take paper and pencil and try to put down in some kind of systematic way our childhood experiences year by year, we find that we can recall much more than we thought we would. One incident draws another into the light of consciousness and this in its turn serves to drag in a third. Many things were retained and were only waiting for a suitable stimulus to make their appearance. While in the midst of recollecting your childhood days, suppose you meet somebody whom you knew intimately when young and whom you have not met for many years; his very appearance, and later his conversation, may bring back another bunch of memories. Another new stimulus had brought to light much new material which was

really retained, though apparently forgotten. A visit to the town of your birth may be yet another fruitful stimulus, which brings into light many a minor incident from the limbo of the past.

Again during delirium, people recall experiences that in their waking life they have long ago forgotten.

What conclusion can we draw from these facts? That we retain much more than we think we do and a good deal of the retained material is available to us only when there is the right kind of stimulus to bring it out. The psycho-analyst is of the opinion that much material that we think we have forgotten is really in the unconscious and could be made conscious by suitable means. Some experiences are forcefully forgotten, or *repressed* because they are unpleasant. There may be some difficulty in bringing them back into consciousness. But ultimately, given the suitable stimuli, we can succeed to a large extent. The suitable stimulus that they advocate is the *method of free association*. The method is a simple one. A person just relaxes, lies down on a couch, and goes on repeating whatever comes into his mind, no matter what it is.

13. Forgetting

We have said a good deal about forgetting under the heading of retention. Forgetting is the failure of retention. Forgetting, however, is not merely a negative matter, it is an active process. This process is less active if the fact of perseveration is respected and enough opportunity is given for consolidation and fixation, by means of proper rest and relaxation. It is least active during sleep when the principle of rest and relaxation is carried to its highest point. The psycho-analyst we saw has suggested that certain types of forgetting result from the active and even forceful thrusting of learnt material into the unconscious.

There is a popular view that the time factor plays an important part in forgetting. This view gives us a misleading picture of the process of forgetting. It suggests that it is merely a matter of the lapse of time. The truth is, it is not only the amount of time that has gone by but what has happened during this time that is important. Especially the time immedi-

ately following the incident or act of memorizing that is important. If at this time suitable steps are taken to fixate the material learnt, then the passing of years will have very little effect on it.

Forgetting is a perfectly natural process. When you learn something new, you are changing your mental make-up, you are introducing a new factor, imposing a new condition. This is resented in the beginning and the mind makes an attempt to shake it off. Forgetting is therefore a return back to normality, a desire to maintain the *status quo*. When this desire is successfully resisted, retention is established.

14. The Rate of Forgetting

The first few days immediately following an act of memorizing are the most critical. We tend to drop a good deal. But what is retained after this stays for a long time. During these critical days we can reinforce our failing memory by constantly reviewing the material learnt. There are other factors also which help us during this adverse period. Of these we may mention two. (1) Meaningful material is forgotten much more slowly than meaningless material. So while memorizing we must always keep an eye on the meaning and even when dealing with nonsense syllables, it is to our advantage to import into them some kind of sense. (2) Overlearned material is forgotten much more slowly than material which has been just learned satisfactorily. We must set for ourselves a high standard. We must not stop when we reach the point of one perfect repetition but go far beyond this. "What is overlearned and kept in the condition of overlearning, constant reflection, application and connection with new subject matter has a chance of becoming part of one's permanent or semi-permanent mental furniture."

15. How to Forget

There are many instances in the life of each one of us when we have passionately desired to forget certain incidents because of their painful or unpleasant nature and found ourselves entirely unable to do so, e.g. a bereavement in the family. The poet Keats, who suffered much and hence had many unpleasant memories, prayed for the gift of insensibility and

envied the trees because they have got it. Byron, when he makes Childe Harold talk of "the blight of life . . . the demon thought", must have also had this tragic inability to forget in mind.

Has the psychologist any advice to give on how to forget? Yes, and it is the simple one of asking you to neglect all the advice he gave you regarding how not to forget. Do not review, especially during the first few days following the incident. This is, however, more easily said than done, especially in the case of bereavement. However, a change of scenery, new activities and such like things may help us to forget by giving us less time to review. Strenuous exercise almost to the point of exhaustion may bring about instantaneous sleep, leaving little time for review in bed. As we have already remarked, time is the great healer not because it is time but because of the things that happen in it. The more time goes by, the more things you do; and the more things you do, the less time there is for you to review or think about the things that you want to forget. This is how time helps us to forget. Murphy sums up the matter well when he says, "In general, things are probably not forgotten through the stately passage of time but through the interference of thousands of other things with which we are occupied (in that time)".

How to forget? Firstly do not review. Secondly, think the matter you are seeking to forget right through to its logical conclusion. Things left half done leave behind much more persistent memories than finished tasks. We saw the important part that perseveration plays in fixing our memory. Experiments show that half-finished tasks perseverate much more than completed ones, and the more perseveration there is the more help our memory gets and less chance of our forgetting. So while the man who wants to remember must make full use of the phenomenon of perseveration, the man who wants to forget must avoid perseveration as much as he can and the only way to do this is to carry the matter through to some kind of a conclusion.

16. Recall

One characteristic feature about memory seems to be that

the four aspects of which it is made up seem to be more or less independent. Mastery in one has no effect on our attempt to master any other. We saw that retention may fail us even though we use expert methods in learning. The same is true of recall, the third process in memory, to which we must turn our attention now. Neither learning nor retention guarantees recall. Much of the retained material fails to turn up at the time we want it. It may turn up later when we do not want it, as every student who has tried to remember a date or fact in a hurry in an examination hall knows to his cost. Using a picturesque metaphor, we say that the matter is in the tip of our tongue. In reality it is somewhere in the brain and something else is blocking it up. When the blockage is removed the matter comes back to us naturally and we wonder how we could possibly have forgotten it.

Blockage then is one of the factors that prevent recall. This may be due to either inhibition or interference. In the case of the student who fails to recall a date which he knows well, blockage is due to the inhibiting influence of fear. The same is the case with what we call stage fright. The aspiring actor is word perfect, but the fear of the audience has inhibited the whole process of recall and he cannot get even one word out. Once off the limelight he gets the whole thing back again.

The failure of recall may be due also to interference. Two ideas may be recalled at the same time, and each blocks the other so that we can remember neither. Perhaps this is what happens in the case of the public speaker who after much fluent speaking suddenly comes to a halt. The drying up of his oratory is not due to fright because he is not a novice, and he has been facing the audience for some time and speaking before them. Two ideas come to him at the same time, he is unable to choose between the two, he hesitates.

When there is a blockage due to interference, the best thing to do is to drop the matter for a while. If this is done one of the two ideas will lose its original force and this will enable the other to come naturally to the forefront of consciousness.

Freud is of the opinion that there are unconscious motives behind a good deal of our forgetting. We forget the things

that are unpleasant to us, things which we do not want to remember. If you forget the name of a person who is well known to you, it means that you no longer want to continue on a footing of familiarity with him. Perhaps he has done something to offend you and though outwardly you may pretend to forgive him, unconsciously you still cherish a resentment which takes the form of forgetting his name. A young man who repeatedly forgets to keep engagements with his *fiancée* is perhaps getting a little tired of her, though he dare not acknowledge that fact openly, even to himself.

17. Memory Images and Eidetic Images

You have an experience and after some time recall that experience. These recalled ideas which are known as memory images are naturally inferior in quality to the original experience. They lack the warmth that accompanied the original experience. Your memories of the holiday spent last summer is not as thrilling as the holiday itself. Memory images only give you general outlines, the details are lacking.

There is one type of memory image, however, which is as vivid as the original experience. This is known as the primary memory image or eidetic image. The eidetic image is continuous with the original perception. Whereas the ordinary memory image cannot be used to get details about the original experience, the eidetic image is so vivid that it can be so used. Eidetic imagery is very strong in children below fourteen years of age.

18. Recognition

Recognition is easier than recall because here there is some external aid to our memory. We have already recalled something, we have now to recognize it as the thing we want or discard it as something not wanted. Recognition may be either direct or indirect. In direct recognition you see a thing and straight away recognize it; in indirect recognition you see a thing and it revives in your mind the original situation in which you first met that thing and you recognize it by the help of this general background. For example, you meet a man in the street, you think you have met him somewhere before

but you are not able to place him. Suddenly the picture of a dinner party comes to your mind and with the help of that picture you recognize the man as one of the guests present. Recognition can also be partial. When this happens we have what is popularly described as a haunting feeling of familiarity. Partial recognition consists of making your original response to a part of the original stimulus that is now repeated. You meet a clown in the street in ordinary clothes. Somehow his appearance makes you laugh, though you have no idea why this is so. Then the picture of the circus ring with the clown in his funny clothes comes to your mind. You have been making the original response (amusement) to part of the original stimulus (the clown minus his costume and circus background).

19. Memory Training

This is a matter on which psychologists are frequently consulted by the general public. They have no magical methods for improving memory, but they can suggest ways in which the four processes involved in memory can be made more accurate and dependable.

1. Memorizing proper—this is perhaps the process which is most susceptible to training. The relative merits of part and whole learning spaced and unspaced learning must be borne in mind, and so also the value of recitation.

2. Retention—a resting state which is not very easy to manage. Keep the brain in good physical condition. Give free scope to the processes of fixation and consolidation. Avoid overwork, anxiety and alcohol.

3. Recall—give your memory a chance. When there is a blockage do not persist in your attempts to recall but drop the matter for a while. Cultivate the power of careful observation.

4. Recognition—this is the process least susceptible to training. Here again a habit of careful observation of details is helpful.

In general do not get into a panic when you feel that your memory is on the decline. There is no psychological evidence in favour of the theory that as one grows older his memory must get weaker. Trust your memory. Give it a fair chance and it will not let you down.

CHAPTER XI

INTELLIGENCE AND INTELLIGENCE TESTING

1. The Nature of Intelligence

A dog sees a piece of meat at a butcher's shop, immediately rushes in and tries to take it. The butcher beats it off the premises, but the next day it may respond exactly in the same way to the piece of meat. A man on the other hand when attracted by the piece of meat thinks over the situation and realizes that he cannot take it because it is somebody else's. Even if he forgets this once and tries to walk off with the piece of meat he rarely does so twice. In what way does the action of the man differ from that of the dog? The dog responds to a striking part of the situation before it, i.e. the piece of meat; the man takes into consideration the whole situation, i.e. the butcher's shop and the law of property. The man is benefited by his past experience, the dog is not.[1] In short the man takes a broader view of the situation, shows adaptation, and thinks over the probable consequences of his action. All these are characteristics of intelligent behaviour.

2. History of Work in Intelligence

Much of the work in intelligence has centred round two closely related problems—the measurement of intelligence and individual differences in intelligence. The beginnings of the matter can be traced to the great wave of humanitarianism that passed over England and the rest of Europe during the opening decades of the nineteenth century. New interest was taken in the diagnosing and curing of mental deficiency and the psychologist was forced by the weight of public opinion to turn his attention also to these matters. One important fact emerged out of a closer study of mental defectives or the feeble-minded, that there were gradations in their intelligence.

[1]The idea of this illustration is taken from Woodworth.

Some could not avoid even the common dangers of life. They put their hands deliberately into fire or refused to get out of the way of a passing vehicle. Others could avoid the common dangers of life but were unable to learn any useful work. Yet others could be trained to perform simple routine work at home like bed-making or sweeping, without supervision.

The study of feeble-mindedness threw some light on the nature of intelligence, for if there were gradations in the intelligence of the feeble-minded, such gradations should also exist among normal people. But nearly a hundred years went by before the next step forward was taken and an attempt was made to measure the intelligence of the ordinary man.

This time the scene is set in Paris. The municipal authorities of Paris were very much worried over the inequalities in intelligence displayed by their school children. It became a very serious problem indeed when the same class contained some very intelligent and some very dull students. For if the teacher adapted his style of teaching to suit the intelligent, the dull boys could not follow him and if he spent time attending to the dull boys, the intelligent ones were getting bored. The school authorities commissioned one Alfred Binet, in the year 1904, to investigate the intelligence of school children and devise some means of measuring the same.

In collaboration with another psychologist, Simon, Binet set about the task of devising tests suited for the detecting and measuring of mental defects. But soon the tests took a more positive form, and were used for measuring different grades of intelligence in normal people also. Binet made use of the important principle that the intelligence of people differed according to their age and he devised tests suited for different ages. He gave not one but many tests, for intelligence consisted of doing many things well. But all the tests had a common factor; they concerned the application of past experience to a novel situation. Working along these lines he developed the concepts of "mental age" and "I.Q." (Intelligence Quotient). Binet made different tests for each year—three, four, five, etc. A child's mental age was represented by the test it passed. Thus, for example, if a four-year-old child was unable to pass the four-year test but passed the three-year test, then its mental

age was three, though its chronological age was four. On the other hand, if it passed the test for five years its mental age was five, even though its chronological age was four. The I.Q. was the mental age divided by the chronological age and expressed as a percentage. So if the I.Q. is hundred, it means that a person has passed the intelligence test for his age. Less than a hundred meant that his mental age was lesser than his chronological age and above a hundred meant that it was more than his chronological age. The I.Q. provides us with a convenient numerical index to a person's intelligence, arrived at by the application of a simple mathematical formula. It has been the starting point of many a subsequent research in the sphere of intelligence.

3. Types of Intelligence Tests

Most of the intelligence tests in vogue today are some kind of adaptations of the original Binet-Simon test, published in 1911. Binet himself died in that year but his work was continued by a long line of experts in England and America. The number of revisions that have been published of this test is itself a testimony to its essential soundness. It was revised twice in France. Three revised versions have been published in the English language, the most well-known being that brought out by the American psychologist Terman, known as the Stanford Revision, in 1916. Cyril Burt has twice revised and adapted it for England.

The Binet-Simon test is an individual test, i.e. it has to be given to one person at a time. This is, of course, the best way of giving a test, as the tester can devote his personal attention to the testee and put him at his ease, and the testee has a chance of doing his best. But if a lot of people are to be examined, group tests are more convenient and more economical from the point of view of time. For by means of a group test hundreds of persons can be examined simultaneously. Group tests first came into vogue during the First World War, when the Army Alpha Test was devised for the use of the American Army. The Army Alpha Test was of great help in picking out the more intelligent type of recruit who could be trained and put on the field in the shortest possible

time. The National Institute of Industrial Psychology (London) has brought out an adaptation of the Army Alpha Test for England. This test, known as Group Test 33, is also the work of Cyril Burt and is widely used. The Beta Test is a performance test, intended for people who cannot read or write.

4. The Contents of an Intelligence Test

The following are some of the problems to be found in an intelligence test:[1]

1. *Synonyms and antonyms.* One word is given and the subject is required to select or supply a second word which has the same or opposite meaning. Example: kind means the same as (soft, friendly, lovely, darling).

2. *Classification.* A set of words is given in which the meaning of all the words but one are in some respects alike. The subject has to underline the odd word. Example: shoot, stab, paint, choke.

3. *Sentence completion.* An incomplete sentence is given and the subject must select or supply the word or words that best complete it. Example: The burglar left the spoons behind because he saw that they were not (his, clean, silver, wanted).

4. *Mixed sentences.* A set of words is given and the subject has to say whether, when the words are correctly arranged, the resulting statement is true or false. Example: Clever escapes a justice always criminal (true, false).

5. *Codes.* A statement is given and the subject has to put it into a code. Example: Code the following message on the principle that each word must first be reversed and that for each letter there must then be substituted the next but one after it in the alphabet—Fifth battalion to return to base.

6. *Number series.* A series of numbers is given and the subject must select or supply the two numbers that continue it. Example: 2, 6, 11, 17 (21, 24, 28, 32, 34).

7. *Analogies.* Three words of which the first two are in

[1]These problems are taken from *Intelligence and Intelligence Tests*, by Rex Knight. I am indebted to this book for much of the material in the three sections following.

some way related are given and the subject has to select or supply a fourth word, which is related to the third as the second is to the first. Example: Sun is to dry as rain is to (cloud, shower, wet, pool).

8. *Inferences.* A problem demanding reasoning is given and the subject must select or supply the solution. Example: Kenneth Digby was five years younger than Sir Thomas Browne and Digby was born on 28th December, 1605. In the year 1600, Christmas was on a Friday. On what day of the week did Browne's birthday fall (Monday, Tuesday Wednesday, Thursday, Friday, Saturday, Sunday).

The subject has very little writing work to do, he has merely to pick out the right answer and underline it. The tests are foolproof, i.e. nothing is left to chance in them. The subject is told exactly what to do and there is little possibility of his making a mistake if he follows the instructions given, provided he has the necessary intelligence to answer the question. Every question has only one possible answer. There is a rigorous time limit and this is imposed to measure the quickness with which the subject responds to novel situations. The tests, at first sight, appear to be a variety of very simple questions in various fields of knowledge but they are really based on a scientific analysis of the nature of intelligence. In answering them the subject has ample opportunity of showing besides his quickness of grasp, the ways in which he has benefited by past experience and his ability to learn and remember. Since all these are the ingredients of the intelligent attitude it is claimed that the results give us a fair indication of the subject's intelligence.

5. Criticisms of Intelligence Tests

The importance of the results given by these tests should not be overestimated. They are generally stated in the form of percentages for the sake of convenience but minute differences in the percentage does not necessarily mean minute differences in the amount of intelligence. The tests only indicate a general tendency and are useful in roughly classifying groups according to the general level of intelligence. They do not claim to measure intelligence with mathematical accuracy.

Most of the individual tests, especially those given to children, are highly standardized. They are instruments of precision and should be used only by experts if they are to produce reliable results.

A good deal of the opposition to intelligence tests comes from ignorance and prejudice. People first of all attribute all sorts of exaggerated claims to them and then find fault for not having achieved these claims. Rex Knight observes "intelligence is one of those topics that many people regard with some degree of fear and consequent prejudice. Even those who depreciate intellect usually want to be or at least to be thought of to be more intelligent than they are. They do not welcome the suggestion that intelligence can be defined and that their own intellect can be assessed and compared with that of other people. They therefore tend to place intelligence under a taboo, to discourage its systematic study, and to decry any attempt to devise instruments by which an individual's intelligence can be measured. They seek to preserve their complacency by condemning those they think may undermine it".

6. Uses of Intelligence Tests

But in spite of criticism and discouragement, intelligence testing has gone steadily ahead and today is put to a variety of uses.

(1) *The diagnosis of mental deficiency.* For this purpose individual tests are better than group tests, for besides noting the marks we can also observe how the person suspected of mental deficiency behaves while doing the test which itself may give us some clue as to the state of his mind. For example, suppose that instead of doing the test he begins to gaze round at the various objects in the room. This lack of concentration may itself be looked upon as a symptom of mental deficiency. Again, apart from the total score that he gets, the type of questions that he attempts, the way in which he tackles them, the nature of his answers—whether merely inaccurate or absurd—may all provide us with some clues as to the state of his mind. The objection is sometimes raised that these tests are unnecessary in this particular

instance, for mental deficiency can easily be detected from a man's general behaviour. It is true that the lower grades of mental deficiency like imbecility can be detected without the help of any tests, but border line cases need careful consideration, and it is obviously unfair to condemn a man as a mental defective merely on the opinion based on haphazard observations by untrained and in some cases prejudiced persons. Even in the more serious cases "standardized psychological tests are much better than unstandardized questionnaires or problems made up by persons with no psychological or statistical training".

(2) *In the grading of pupils*. Intelligence tests are being now widely used in schools to roughly classify pupils as they enter an institution. In colleges also professors may use these tests to form some idea of the mental calibre of their students at the beginning of a course of studies. This would enable them to adjust their lectures to suit the level of the majority of the students. The great advantage of intelligence tests over examinations is, being tests of capacity and not of knowledge, they may be given at any time, whereas examinations being tests of knowledge can only be given after a prescribed course of studies has been gone through.

(3) *Child guidance*. The problems and difficulties of children are no longer treated as silly inconsequential matters, they are receiving increasing attention in all civilized countries. There are now child guidance clinics in almost all the big cities of Great Britain and of America. Here trained psychologists deal with the peculiar difficulties of children which mere parental commonsense or traditional methods of the nursery are unable to cope with. The problem child, i.e. the child who though not a mental defective is yet unduly "mischievous", unruly or incapable of ordinary progress in school, is specially dealt with in these clinics. Intelligence tests have played a valuable part in diagnosing the trouble with these children. "Some children," for example, "are reported to be generally backward or poor at reading and counting. Often when we apply an intelligence test we find that the condition is due merely to a lack of intelligence; not to any fault of the teacher or parent, nor to laziness or timidity on the part of

the child. On other occasions, however, the use of intelligence tests shows that the child's backwardness is not due to dullness; and this negative information is also of importance in that it directs our inquiries to other conditions among which the cause may be found."

(4) *Vocational guidance and selection.* Many young people nowadays do not leave the important matter of the choice of a career to merely personal or parental whims or even economic considerations but seek the advice of a psychologist. The latter, after giving many tests to measure the young person's various professional capacities, interviewing parents and teachers and making an exhaustive survey of all relevant circumstances, advises his subject as to the profession best suited to him. In the giving of such advice intelligence tests play a valuable part. For obviously certain professions tax one's intelligence to a much greater degree than others.

7. Facts about Intelligence

By the wide scale application of intelligence tests in England, America, France and other countries a large amount of data has been gathered about the nature of intelligence. An analysis of these data has enabled psychologists to establish certain facts about intelligence.

(1) *The I.Q. remains constant.* As the chronological age of a child increases so does his mental age, so that the ratio between the two is always more or less the same. For example, if a five-year-old child has a mental age of four and hence an I.Q. of eighty, when she is ten years old she will be able to pass only the test for the eight years old, so that her I.Q. will again be eighty. In all the intervening years her chronological age will always be a quarter more than her mental age. Conversely, if a child's mental age to start with is above her chronological age (say I.Q. 120) she will always maintain this advantage.

(2) *Intelligence stops growing after the fifteenth year.* If the I.Q. is constant, then it is clear that intelligence grows, for mental age must grow and keep pace with the chronological age so that at any given time the two may have the same

after a certain age. The exact point at which intelligence stops growing is still a matter of dispute among psychologists. "Some psychologists fix it at fourteen; Binet fixed it at fifteen; Otis and Munroe fixed it at eighteen." The weight of evidence so far available tends to put the age at about sixteen. Here are some figures:

Ballard gave a test in which the highest possible score was 34 to 2,000 persons of different ages and the following average scores show no improvement after the age of sixteen:

11	..	13·1
12	..	14·4
13	..	15·1
14	..	17·4
15	..	18·5
16	..	18·9
17	..	18·9

Many other psychologists have also got results similar to the above.

This fact that intelligence stops growing so early in life need not unduly discourage us. It is true that at fifteen one has hardly started life. This is the time when one generally leaves school and is about to begin the more serious part of his studies at college. Intelligence seems to stop growing at a time when one needs it most, but though intelligence stops growing intellectual life does not. The more one reads, the more experience one has, the greater will be his chances of using his stock of intelligence to the best possible advantage. To have intelligence is one thing, to use it wisely is another matter. This wisdom is largely a matter of experience.

After intelligence has reached its highest point of growth, does it remain stationary or does it deteriorate? Intelligence tests have thrown light on this matter also, though there is some difference of opinion. Figures so far available are inconclusive. There is no doubt that there is no decline up to the twentieth year. After this some investigators have found a certain amount of gradual decline. Others have found no decline up to the onset of advanced old age. Results differ

according to the nature of the tests used and the nature of the subjects.

(3) *Intelligence is hereditary*. If we have a fixed amount of intelligence and it stops growing after a certain time then it is highly probable that it is hereditary, and so it is. This is a serious statement to make and like the first fact about intelligence (i.e. that the mental age remains constant) a depressing one. For it seems to cut out all human endeavour in the matter. Psychologists have come to this conclusion about the hereditary nature of intelligence only after extensive and careful investigations. Perhaps twins supply us with the best bit of evidence. Identical twins separated and brought up under different circumstances seem to get invariably the same scores in intelligence tests. Now if intelligence was not a matter of heredity but had something to do with the environment, then, as the environment of the twins differed so their scores also must differ. "Burt applied intelligence tests to pupils in two different schools. One of these schools was a preparatory school, where almost all the boys were sons of men who had attained to intellectual eminence. The other was an elementary school, where boys were mostly sons of local tradesmen. In most respects and particularly in the quality of the education provided, the two schools seemed to be on an equal footing. Nevertheless, the boys at the preparatory school scored much higher marks at the tests."

That intelligence is hereditary need not, however, unduly depress us. After all intelligence, though an important asset, is not the sole one needed for success in life. Besides, as we have already noted, though the quantity of intelligence is fixed, there is no limit to the ways in which one may use it. One person may allow a large amount of intelligence to go to seed, another may make the most of even half that amount. At the same time this is a fact of first-rate importance to all legislators and guardians of public health. Unfortunately in many countries mental health is not taken so seriously as physical health, though the former is perhaps as important, perhaps even more important, for a nation's prosperity. The science of eugenics has been sadly neglected. When eugenics is taken more seriously, it will be possible to level up the glaring

differences in the intelligence of people. Feeble-mindedness, which is also hereditary, can be gradually eliminated.

(4) *Intelligence varies with occupational groups.* This is almost a corollary from the fact that intelligence is hereditary. Some occupations, like the learned professions, require more intelligence than others, where the main emphasis is on manual labour. People practising the same profession are drawn together; there is a good deal of inter-marrying, and thus the intelligence level is kept up at roughly the same point among the various occupational groups.

(5) *Intelligence tests have failed to disclose any difference between the sexes.* This settles a very old controversy. Of course girls differ as much as boys in their intelligence, but any given girl of ten is not more intelligent than any given boy of ten, just because she is a girl. Burt, however, did find some slight differences between the intelligence of boys and girls. He tested nearly 3,000 London children and found that the difference between girls and boys was most noticeable at about the sixth or seventh year (in favour of girls). At about the age of ten, the boys seem to have the advantage, at fourteen the girls regain their former supremacy. Burt thinks that these differences are not significant and attributes them to the fact that girls mature earlier than boys.

(6) *There is some relation between intelligence and character.* "Although there are, no doubt, many interesting relations between intelligence and character," says Rex Knight, "our knowledge of them is at present uncertain and incomplete. There is some evidence that the bright person is willing to take the lead, more eager to break new ground, and more disposed to talk than the person of average intelligence. It also seems possible that intelligence is positively correlated with freedom from mental inertia. The highly intelligent person is active, and he can pass from one train of thought or task to another with rapidity and ease."

"There is more evidence on the negative side. Lack of intelligence and lack of character often go together, although this is not to deny that there are many intelligent roués. When all is said and done, crime is a stupid business and most criminals are stupid." They are stupid because they fail

to see the somewhat obvious fact that if they are caught the penalty they have to pay is out of all proportion to such gain as their criminal career may bring them. Burt has shown that nearly 80 per cent juvenile criminals in the cases that he investigated were below average intelligence and 8 per cent were mentally defective (i.e. had I.Q. below seventy). "The defective child," he says, "is without the necessary insight to perceive for himself, or to hold effectively in his mind, that what tempts him is dishonest and that dishonesty is wrong."

(7) *There is some relation between intelligence and physique.* The nature of this relationship is even more vague than that between intelligence and character. In cases where people suffer from paralysis and there is a gradual decay in their nervous system, their intelligence also decreases appreciably. This suggests that there is some connection between intelligence and the nervous system, a suggestion which is in consonance with the general psychological belief (as yet unconfirmed) that people whose reflex action is very quick have also a very high I.Q.

Deficiency in the functioning of the endocrine glands may also affect intelligence, especially defects in the thyroid secretion. When this is set right there is an almost miraculous shooting up of the I.Q. of the patient. Simple bodily ailments like adenoids or tonsils and even general malnutrition have some effect on the mental life of children and when corrected their intellectual potentialities are fully realized.

(8) *The intelligence of any given group of people is distributed according to the normal probability curve.* The principle behind the probability curve is this—supposing we are measuring a fairly large number of people for a particular trait, say tallness, it will be found that a small number of them are very tall and a small number of them very short, while the majority will be more or less average in height. The same is true of the death rate of a given population. Though we cannot say when a particular man in that population will die, we can roughly calculate what percentage will die as infants, what percentage will reach advanced old age and how many will die in middle age. The percentages will be like those of height. Death rate

follows the probability curve. This curve is true of many physical phenomena and certain mental phenomena also.

"There is abundant evidence," says Rex Knight, "that intelligence is similarly distributed. Many years ago Terman found that the intelligence of 1,000 unselected children followed the normal curve and this finding has been corroborated by many other investigators." In 1921, for example, Thomson found that 2,710 Northumberland school children had the following intelligence quotients:

I.Q.	*Number of children*
Below 60	21
61–71	83
71–90	226
81–90	475
91–100	644
101–110	596
111–120	400
121–130	189
131–140	65
Over 140	11

8. Spearman's Contribution to the Study of Intelligence

The recent epoch-making discoveries of Spearman have thrown much new light on the whole question of the nature of intelligence and its measurement. Unfortunately his theory is not one which is easy to follow or formulate in a few words. At places Spearman is as abstruse as Kant himself, with whom he has a good many affinities. Like Kant he asks the question, "What are the conditions to be fulfilled before knowledge is possible?" He answers this question by his theory of Noegenisis.

Noegenisis is a word coined by Spearman himself—and puts forward a new psychological doctrine of knowledge. It attempts to answer the question how each individual mind thinks and knows. The older theories of knowledge like the doctrine of association of ideas or the doctrine of faculties were given up long ago but there were no new theories to take their place. Spearman supplies this need. While Freud was

studying the unconscious with spectacular results, Spearman was steadily plodding on with the analysis of the conscious life of man.

There was at this time considerable confusion as to the exact nature of the cognitive process. Several conflicting theories were put forward. Spearman classifies them under three heads—the anarchic view, the monarchic view and the oligarchic view. The monarchic view assumed that the mind had only one great power called intelligence and it used it in all knowing processes. All knowledge was the result of using the sovereign power of intelligence. Intelligence was thus made into a jack of all trades. Since it was everything it practically amounted to being nothing. "The word intelligence," says Spearman, "is cankered with equivocality." (e.g. is memory part of intelligence? What about imagination?) Terman says, "We can measure intelligence though we may not know what it is." Refuge was taken in obscurantism.

Binet himself believed in the monarchic doctrine—one supreme faculty called intelligence which was responsible for all our knowledge. That was why his tests were such a miscellany. But Binet was the first man to give us a large range of really useful tests. He measured something, and people in their enthusiasm for his concrete device forgot to ask what it was that he was measuring. Binet's success was astounding. "Teachers found in the tests of intelligence something that they could handle and the public got what it wanted." Binet's tests appeared in 1911; by 1921 the enthusiasm for them was dying down. The atmosphere was getting distinctly critical. Conference after conference met in England and America to discuss this question but no constructive results were forthcoming. Let us summarize the state of our knowledge about intelligence at the time of Spearman's contribution in his own words thus:

"On the whole the chronicle of modern intelligence has been dramatic. The first act shows it rapidly rising to a dazzling eminence. But in the second there begin to be heard notes of criticism which soon swell into an insistent hostile chorus. The most enthusiastic advocates of intelligence tests became doubtful of them, themselves. For hav-

ing naïvely assumed that its nature is straightway conveyed by its name, they now set out to discover what its nature really is. In the last act the truth stands out revealed, that the name has really no definite meaning at all, it shows itself to be nothing more than a hypostatized word, applied indiscriminately to all sorts of things."

According to the oligarchic view it was held that intelligence was not one supreme faculty but that it entered into all the seven classes of faculties. These faculties are: sense, imagination, intellect, memory, speech, attention and movement.

The criticisms commonly applied to faculty psychology can equally well be applied to the oligarchic doctrine which is based upon it. Do such clear-cut formal faculties exist in our mind and do they always function as single units. On closer examination each faculty breaks up into a number of smaller units and the question must be asked to what extent does intelligence enter into each of these units. For example, the faculty of judgment breaks up on closer examination into several smaller compartments like politics, sports, business methods, etc. Can all these subsections be measured by the same test? No, unless they are all so interdependent that the man who is good at making political judgments is equally good at making judgments on the sporting field or in the business world. We know from experience that this is not true. Many different types of tests seem to be needed to measure the ramifications of even a single faculty like judgment.

The third view, the anarchic view, seeks to rectify the criticism levelled against the oligarchic view. It splits up intelligence into the knack of doing, and doing well, a number of totally unconnected activities. "First the sovereign intelligence was broken into a number of ruling faculties and then the several faculties were further broken up, for each covered a variety of mental operations, so far as could be seen, more or less independent. To what point then will all these subdivisions lead? It leads to a movement of all-round independence." We have in Thorndike a good exponent of the anarchic view. He says, "The mind is a host of highly specialized, particularized, independent faculties."

Having reached this stage, it is but natural that psy-

chologists should turn their attention to the question, are there any common factors underlying these various activities covered by the word intelligence? This is where Spearman comes in. His was the task of finding such common factors. Of course, he was not the first one to try and do so, but he was certainly the first one to have a great measure of success. Referring to the anarchic view, he says, "This crude doctrine of independence was given up later in favour of the view that the numerous particular abilities were capable of correlation. Thereafter, the whole problem at issue was to discover some aspect from which the intercorrelation can be rendered intelligible. . . . Just as in the physical world, not even the smallest movement of the smallest particle of matter can occur without a part being played by different factors like heat, weight, electricity, so also there is a likelihood of every concrete mental operation being dependent on numerous abstract influences or factors as they have been called in psychology".

9. Spearman's Theory of Intelligence

The theory attempts to answer the question, how exactly and in what proportion does intelligence enter into the various activities that a so-called intelligent man indulges in? Spearman's answer to this question is based on nearly twenty years' research on the matter, carried on by himself and a number of his colleagues and students. The proof of the theory is based upon an elaborate application of mathematical and statistical devices to the results of various types of intelligence tests. The new idea that Spearman introduced into the study of intelligence was that intelligence was not one but two things. Most normal activities of the human being contain two types of intelligence—the G factor and the S factor, a general and a special factor. G, the general factor, enters in all cognitive acts. It is what we may call intelligence proper. Though differing greatly from individual to individual, it remains the same for an individual in respect of his abilities that can be measured. S is the special factor. It is a special type of intelligence that a man possesses in respect of one type of activities only, e.g. music or drawing. A man with a large amount of S is intelligent in regard to one particular type

of activity. He may be quite dull in all other respects. Whereas a man with a large amount of G is intelligent in all his general type of activities. G spreads out more, S is sharply localized.

By further mathematical calculations Spearman found out that in certain types of abilities general intelligence or G enters much more than S. On the other hand, in certain other types of activities, gifts as they are popularly called, there is very little of general intelligence but a large amount of S. In classics, for example, the relation of G to S is fifteen to one, whereas in music the ratio is one to four.

10. Practical Uses of the Two-Factor Theory

We can now measure intelligence more accurately than before. We can measure a person's general intelligence as well as any special aptitudes that he may have. We thus get a more complete picture than those given by previous tests. Intelligence testing is thus put on a more accurate and scientific basis. Rex Knight observes "Spearman may therefore be regarded as having shown that intelligence enters into all our cognitive abilities. And this is a most important discovery in the light of which the whole basis of our intellectual life becomes far easier to analyse".

11. Spearman's Conception of the Nature of Intelligence

To analyse and measure intelligence is one thing, to say what exactly it is is another and a more difficult matter. Perhaps Spearman has analysed intelligence more accurately than anybody else and has helped us to measure it with greater precision than before. But does he succeed any better than the others in telling us what exactly intelligence is? Psychologists as a rule tended to be rather vague about this matter. As Ballard puts it, "While the teacher tried to cultivate intelligence and the psychologist tried to measure intelligence, nobody seemed to know precisely what intelligence was". Terman, for example, says that we can measure intelligence though we may not know what it is. He compares intelligence to electricity. We make use of electricity though we do not know what it is. Similarly, we measure intelligence though we may not know its exact nature. Not that several thinkers

and psychologists did not attempt to give a definition of intelligence. Here are a few:[1]

Spencer and his modern followers like Stern—"Conscious adaptation to new situations".

Thorndike—"The power of good responses from the point of view of truth".

Buckingham—"The ability to act effectively under given conditions".

Thurstone—"That which can be judged by the incompleteness of the alternatives in the trial and error life of the individual".

Peterson—"A biological mechanism by which the effects of a complexity of stimuli are brought together and given a somewhat unified effect in behaviour".

Ebbinghaus—"The power of combination".

These definitions show that people were groping after a right understanding of the problem of intelligence. Some stressed one aspect and some another. It was left to Spearman to do away with partial approaches and make a comprehensive survey of the situation. According to Spearman intelligence is made of three abilities:

(1) The ability to observe one's own mental processes, to make our apprehension clear and definite as distinct from faint or vague.

(2) The ability to discover essential relations between items of knowledge, whether perceived or thought of. For example, if two words like truth and veracity are given one has to say whether the meaning of the two words is the same or opposite, or a word is given and one has to select from several other words another that has the same meaning—kind; soft, friendly, lovely, darling.

(3) The ability to educe correlates. Spearman defines the eduction of correlates thus: "the presenting of any character together with a relation tends to evoke immediately a knowing of the correlative character". For example, if an idea like black and a relationship "opposite" is given, one educes the other idea white.

[1]Quoted by Spearman in *The Abilities of Man.*

It is worth noting that in speaking of intelligence as referring to things perceived or thought of, Spearman has provided a healthy corrective to the prevailing tendency to regard intelligence as a matter of thinking or of ideas. "We can exhibit intelligence not only in puzzling out answers to elaborate abstract teasers, but also in solving a jigsaw puzzle, in searching for the cause of a breakdown in our motor-car, in burgling a house or in other practical problems."

CHAPTER XII

FEELING AND EMOTION

1. Feeling—Popular and Technical Use of the Term

In popular usage the word "feeling" covers a wide variety of experiences. The most common use is perhaps to refer to an excited state. It is also sometimes used to indicate the aftermath of an emotion, for example, after an outburst of temper we say we are feeling all upset for some time. It may even denote a sense of tension and vague foreknowledge. I am feeling all worked up, we say, or I feel it in my bones that something is going to happen. Even purely physiological states are sometimes described as feelings—states like the pounding of the heart, moisture on the skin and warmth in the face.

In the strict psychological sense it is used to indicate a state that is not connected with sensation. It is a general stirred up state of the organism, something that remains as a background to our activities rather than a definite expression in any particular type of activity. Pleasantness and unpleasantness are the best examples of feeling and they tell us something of its diffused nature.

2. The General Characteristics of Feeling

Feeling is a purely subjective phenomenon. It does not lend itself easily to definition. But we know for certain that it is conscious and that it exists as a sort of background or undercurrent in us and colours most of our activities. Pleasantness, the most typical of feelings, indicates that the impressions made by an object on an organism are congenial to it and also adapted to its needs and capacities. Unpleasantness, the opposite feeling to this, indicates that the impressions made by an object are ill-adapted and harmful to the organism.

Since they exist as a background to the main stream of our activity feelings are not localized. One feels pleasant or

unpleasant all over the body, so to speak, and not at any particular part.

Pleasantness and unpleasantness are the two fundamental feelings and almost all our experiences possess either of these qualities to some extent. The degree to which an experience is pleasant or not is known as its *feeling-tone*. Sweet and bitter tastes have very high feeling-tones because they are always accompanied by a very high degree of the feeling of pleasantness and unpleasantness, whereas the salty taste does not have a very high feeling-tone because it does not stir our feelings in any marked way.

Feelings tell us little about the nature of the external world but a lot about its effect upon the experiencing human individual. In this respect they differ widely from sensations. Sensations always tell us something about what is happening in the external world. When one is feeling pleased with a new car that he has recently acquired, the feeling and the car are features of his experience, but it is the car that is new and the man that is pleased. A stranger looking at you and the car may not be able to tell what exactly are your feelings.

3. Royce's Bidimensional Theory of Feeling

It is generally recognized that all feelings have at least one quality, i.e. they are either pleasant or unpleasant. Royce claims that there is another quality that is universal to all feelings, restlessness or quiescence. Thus every feeling has at least two dimensions. By restlessness is meant mental disquietude and not fidgetiness. Quiescence does not merely mean a pleasant state of contentment. It need not be pleasant at all. A quiescent feeling occurs when our whole organism is relaxed, when we take no particular interest in our surroundings and the changes going on in them. For example, the state of semi-consciousness that precedes sleep when we are contented and at peace with the world. On the other hand, expectation, curiosity, hope and suspense are the characteristic features of the restless feeling. We are restless because we are actively dissatisfied with our present experience and want to change it.

The bidimensional theory gives four possible combinations

of feeling—a restless pleasant feeling as in the case of our feeling pleased with an experience, but at the same time afraid that it may not last as long as we want it to. The quiescent pleasant feeling happens when we are not only satisfied with an experience, but also feel certain that it will endure. There can also be a restless unpleasant feeling, a very common experience when we are dissatisfied with an experience and want to get rid of it, and also a quiescent unpleasant feeling when we are dissatisfied with an experience but reconcile ourselves to its continuance.

4. Wundt's Tridimensional Theory

Royce's two feature theory is really a modification of Wundt's famous theory which envisages three aspects to every feeling. To pleasantness and unpleasantness Wundt adds tension and relaxation and excitement and quiescence. He appeals to introspection for evidence in favour of this theory. If we examine ourselves he says we will find that every feeling creates within us states of either tension and relaxation, excitement and quiescence. Some people's experience may bear this out, others may not. The theory cannot be very satisfactory as long as it rests purely on subjective evidence.

But the experiments of Alechsieff have given it some objective status. Alechsieff has established the occurrence of the straining and relaxing, the exciting and depressing states. He has also shown that pleasantness and unpleasantness can occur in combination with any one of the other four feelings recognized by Wundt. By the use of appropriate stimuli Alechsieff put his subjects in an intensely excited state, then recorded both their pulse rate and breathing and also took down their introspections.

According to Wundt any given feeling may have three qualities. For example, we may have a pleasant tense excited feeling or an unpleasant tense subdued feeling. There may be also various degrees in each of these qualities. Wundt therefore provides for a large variety of gradations in our feelings.

The tridimensional theory has not received the unqualified approval of psychologists. Woodworth criticizes it on the

ground that excitement and rest cannot be placed on the same footing as pleasantness and unpleasantness as elementary feelings. They really seem to be a blend of many sensations and not elementary feelings at all. "That our general condition," says Angel, "is sometimes one of strain and sometimes one of relaxation admits of no doubt. But awareness of this condition of strain or relaxation is due primarily to the peculiar sensations that come from our muscles."

The theory has also been criticized on the ground that it is too subjective in nature, depending as it does on introspective evidence. This defect has been remedied to a certain extent by experimental studies. But all that experiments have so far proved is that straining and relaxation, excitement and numbness, can go with pleasantness and unpleasantness. They have not shown whether these states are elementary feelings or blends of sensations. "The outcome of experiment," says Calkins, "is very far from conclusive in Wundt's favour. This theory has, therefore, found little favour outside the narrow circle of Wundt's fellow-workers and students."

5. Emotion and Feeling

Emotion like feeling is a diffused state not localized. Just as we feel pleasant or unpleasant all over the body we feel angry or amused in a diffused sort of way and not in any particular spot. Both are conscious stirred up states of the organism.

At the same time, there is also much difference between the two states. If feeling is a gentle stream, emotion is a raging torrent. Feeling manifests itself as a sort of background to our activity. It lasts for hours together and colours our general outlook as long as it lasts. Emotion, on the other hand, grips us and sweeps us off our feet. We are its slaves as long as it lasts, but it does not last very long. Emotion is also less vague than feeling. Though not localized yet it is followed by bodily changes generally of a glandular and visceral nature. Besides, each emotion expresses itself in a definite way. We know that a man is angry from the way he behaves—the clenching of his fist, the curling of his lips, etc. Also there are many more emotions than feelings.

6. Emotion and Reason

While emotion is often confused with feeling it is frequently contrasted with reason. Emotion is warm, reason is cold, the one belongs to the heart and the other to the head. Man is commonly described as a creature of emotion. There is a touch of reproach in this description. It is suggested that his actions are more often guided by emotional impulses than by intellect or reason. Moralists have looked upon such behaviour as very unsatisfactory. The more we subdue our emotion by the use of our reason, the better we are said to have gained control over ourselves. Even the philosopher Kant calls emotion a disease of the mind. As psychologists we cannot praise this tendency. It is impossible to acquire a well-balanced personality either by denial or over-indulgence. Every human trait must be given its proper place in the scheme of life.

7. General Characteristics of Emotion[1]

(*a*) Its wide range. Emotion is common to all forms of life and is to be found in every stage of growth. "A cat will become angry if you interfere with its kittens. A child will become angry if you take away its toy. A man will become angry if you fail to understand his argument or unfavourably criticize his book. A saint may also become angry *qua* saint as St. Paul was angry with the foolish Galatians."

(*b*) The varied nature of the conditions that arouse it. "It is a certain general kind of situation and not a specific class of objects which excite a certain kind of emotion." It is not the son but what he does that makes a father happy or sad. If he sees him stealing apples he is sorry; if he sees him helping a blind beggar he is happy. The behaviour aroused by an emotion is not directed towards a particular object but is "a general mode of action adapted to a certain kind of situation."

(*c*) Emotion may arise from two sources—perception and ideas, or organic changes. The idea of an approaching holiday may throw you into a state of great good humour but so would the bodily changes brought about by alcohol. We have all

[1]As expounded by Stout.

experienced the truth of the statement that a man's temper varies with the state of his health.

(*d*) It leads to an emotional mood. This is what we may call the aftermath of an emotion. After the intense phase of an emotion is over its effects persist in the form of an emotional mood and colour our attitude to life for a considerable length of time. Suppose a man gets some good news at the beginning of the day. First there is a period of intense exultation—the emotion proper. But even after this is over he is in good humour for the rest of the day and things that ordinarily leave him indifferent may now seem pleasant. The good mood caused by the initial experience persists.

(*e*) Its parasitical character. The occurrence of emotions presupposes the existence of certain specific tendencies or instincts in us. Emotions arise when these instincts are being satisfied or thwarted. McDougall has brought this out clearly in his treatment of the nature of instincts.[1] It is because we have the sex instinct that we are happy in the society of the other sex or get angry when obstacles are put in the way when seeking sexual satisfaction. "The anger produced in the dog by taking away its bone presupposes the specific appetite for food."

8. Bodily Changes During Emotion

Every emotional experience is accompanied by certain bodily changes. These changes are brought about by the action of the autonomic nervous system and certain glands in the body.

(*a*) *The autonomic nervous system.* We have already noted the important part that the central nervous system plays in our mental life. The autonomic nervous system is a branch of the central system and comes into action during emotional excitement of its own accord.

The system is composed of long thin strands of nerves which come out of either the brain stem or the spinal cord and run into certain glands of the body and also into the visceral organs like the stomach, heart, lungs, etc. The upper section of the autonomic is known as the vagus. It comes

[1] *See* p. 161.

out of the brain stem and runs into the heart and stomach and is capable of slowing down the action of the former and stimulating the glands and muscles of the latter. The feeling that most of us have of calmness and contentment after a good meal is mainly due to the action of the vagus. The middle section is made up of nerves coming from the upper portion of the spinal cord and its action is opposite in nature to that of the vagus. It hastens the heart-beat and checks stomach activity. This system is active in anger and fear. The lower section runs into the sex organs and the lower abdominal regions. It is active during sexual excitement.

(*b*) *The endocrine glands.* There are two types of glands in our body. Glands of external secretion like the tear glands or the sex glands and glands of internal secretion also known as the ductless or endocrine glands. These throw out their secretions known as hormones directly into the blood stream where they are quickly assimilated by the body and the effects thereof immediately felt. There are a few such glands which directly come into operation during emotional experiences:

1. *The adrenals.* These are two little glands situated above the kidneys. They secrete a hormone called adrenalin into the blood stream. Adrenalin has an immediate effect on the liver and a large amount of sugar is thrown into the blood stream. As sugar is fuel for our body, this gives the person having the emotional experience a certain amount of extra energy. It also increases the blood pressure, checks digestive activity and dilates the air passages in the lungs.

2. *The thyroid.* This is a large shield-shaped gland situated in the throat. The secretion of the thyroid acts as a powerful stimulant on the body, thus placing at the disposal of the emotionally excited individual a large amount of extra energy. "It acts strongly in times of danger, of emotional and sexual excitement and mental crises." The more immediate effects of thyroid activity are increasing the rate of combustion and increasing the speed of nervous conduction.

3. *The gonads.* These are the sex glands, the testes in the male and the ovaries in the female. These have both internal and external secretions. The internal secretions produce in us the secondary sexual characteristics like hair in

certain parts of the body, changes in the voice, development of the breasts, etc. The emotions connected with sexual excitement would not be possible but for the proper functioning of the gonads.

4. *The parathyroids.* These are two little glands near the thyroid which are also intimately connected with our emotional life. People who have some defect in these glands are emotionally unstable—they are fidgety and restless and find it difficult to concentrate their attention on an object for any length of time.

5. *The pituitary.* This gland is attached to the inside of the brain and may be looked upon as the most important of the endocrine glands as all the others are dependent on its hormones for their normal development and functioning. The secretions of the pituitary has also great influence on bodily growth. If the gland is over-active in childhood it may make people grow into gigantic size; if under-active may produce dwarfs and midgets.

9. Bodily Changes as Preparatory Reactions

What is the net result of the changes brought about by the action of the autonomic nervous system and the endocrine glands? They enable the organism to meet successfully the crisis created by the emotional experience. More sugar is poured into the blood stream so that the angry man feels surprisingly strong, the digestive process is stopped so that the blood usually used up here may be diverted to other parts where it is more urgently needed. Vigorous breathing and rapid circulation of the blood have also a certain amount of tonic effect on the organism at a time of emergency. Other bodily manifestations like "dilation of pupils, sweating, dripping saliva" were perhaps of more help during primitive times than now.

10. The James-Lange Theory of Emotion

When do the bodily changes occur? Before or after the emotion? This has been a matter of considerable controversy. The James-Lange theory attempts to settle this question. Put forward independently by the American psychologist, William

James in 1884 and the Danish psychologist, C. G. Lange in 1885 they have been amalgamated into a single theory because of the similarity of views expressed. Each, however, approaches the problem from a different point of view.

(*a*) The theory as put forward by James. The popular view regarding emotion is that it is a mental state coming in between the perception of the object that arouses the emotion and the bodily state that follows such a perception. As against this James contends that the bodily state comes before the emotion and not after, that in fact what we call the emotion is merely the sum total of the sensations proceeding from these bodily changes. James's theory is therefore a dramatic reversal of the popular theory and is strikingly expressed in the statement, "We do not tremble because we are afraid but we are afraid because we tremble".

As we have already noted, the bodily changes that accompany an emotion are many and minute. Suppose, asks James, if anyone tries to produce all these changes in the body in the absence of the object that usually arouses the emotion, will he have the emotion in its fullest form? For example, suppose a man begins to tremble, sweat, breathe deeply and have other physical manifestations usually associated with fright, will he have the emotion of fear with the same intensity as when he has it on meeting a tiger in the forest? Of course not. The artificially produced emotion has not got the same warmth as the natural one. This is so, because all the bodily changes connected with the emotion have not been produced. It is not possible for us to control the beating of our heart or the secretions of our liver. If our emotion is the sum of the bodily changes that go with it, then the lessening of the bodily changes must naturally result in the emotion decreasing in warmth and this is exactly what happens in experience.

All the bodily changes that accompany an emotion can be felt. "If the reader," says James, "has never paid any attention to the matter he will be both interested and astonished to know how many different local feelings he can detect in himself as characteristic of his various emotional moods. Our whole cubic capacity is sensibly alive and each morsel of it contributes its pulsation of feeling dim or sharp, pleasant,

painful or dubious to that sense of personality that every one of us unfailingly carries with him."

If every emotion is accompanied by bodily changes and if these changes can be felt, let us subtract these feelings of bodily changes from the emotion and see what is left. "If we fancy some strong emotion and try to abstract from our consciousness of it all the feelings of our bodily symptoms, we find we have nothing left behind." James admits that this act of subtraction is not very simple and does require considerable introspective skill. But if we succeed in doing it we will find that there is no emotional state independent of the sensations resulting from bodily changes.

(*b*) The theory as put forward by Lange. Lange says that there are two tangible factors in every emotional experience. 1. A cause—the sensory impression that starts the emotional experience. 2. An effect—certain bodily changes. These two factors are certain: the only question is whether there is a third factor intervening between the first and the second. The popular view is that there is a mental state called emotion intervening between the sensation and the bodily changes. Lange is of the opinion that this conception of an intervening mental state is purely an hypothesis. Is there any justification for making this hypothesis? In the first place it cannot explain any of our bodily changes. "Can mental fear explain why we turn pale and tremble?" Secondly, the phenomenon of emotion can be very well explained without this hypothesis of a mental state, by saying that the sensations caused by the bodily changes are the emotion. The only justification for making a hypothesis is that it explains a phenomenon that otherwise cannot be explained properly. The phenomenon of emotion can be completely explained without the hypothesis of a mental state and therefore there is no need for making it.

(*c*) Criticisms of the theory. Specific points in the theory have come in for a good deal of criticism. Th. A. Ribot points out that both the popular view as well as the theory under consideration talk of a cause and effect in emotion, though in the latter case what was cause in the former becomes the effect. "In my view," says Ribot, "there would be great advantage in eliminating from the question every notion of cause and

effect every relation of causality and in substituting for the dualistic position a unitary or monistic one. No state of consciousness can be dissociated from its physical conditions, they constitute a natural whole which must be studied as such."

The theory does not lend itself easily to experimental verification, but the work of Charles Sherrington, though not conclusive, throws a good deal of light on the matter. He tells us that by means of an appropriate operation it is possible to remove completely and immediately the sensations of the viscera and of all the skin and muscles behind the shoulder. Such an operation was performed on one of Sherrington's laboratory dogs, "but the reduction of the field of sensation in this animal produced no obvious diminution of its emotional character". In fact, new emotional reactions, like disgust for dogs' meat, which he had never tasted before, appeared. This, of course, is not conclusive proof against the theory. In the first place, the operation did not affect the facial sensations. Secondly, we can never be certain that the dog did actually have emotions after the operation, for it may merely have continued to act as it acted before, by force of habit. Lastly, the dog may have reproduced in memory the sensations accompanying any emotion that it used to experience before the operation and these memory images may have been strong enough to cause emotional behaviour.

W. B. Cannon, who has done extensive work in the field of bodily changes accompanying emotion, is on the whole a favourable critic of the theory. He suggests that the distinctive feature of each emotion is due to those bodily changes other than the visceral, for all big emotions produce exactly the same kind of visceral changes.

All critics, however, agree that the theory is a distinct contribution to the study of emotional experience, its most characteristic feature being that it emphasizes an aspect of emotional life that had been hitherto much neglected—the bodily changes. It strengthened the movement, then in progress in psychological circles, to wean the science away from too great a preoccupation with the speculative side and to give it a healthy biological foundation.

11. Central *versus* Peripheral Theory of Emotion

The central theory claims that emotional disturbances are due to the stimulation of one particular area in the brain; the peripheral theory claims that an emotion is due to the sensations coming from the various senses, the muscular and visceral sensations and the activity of the endocrine glands. The former centralizes the cause of emotions, the latter distributes it. The James-Lange theory is a peripheral theory.

The central theory at once raises the question—If emotion is connected with some particular spot in the brain, can this spot be located? Many attempts have been made to locate the emotional centre in the cortex, but so far with little success. We have seen that in the somesthetic area of the cortex every sensation has a centre but the emotions are not similarly represented. The search must therefore be carried on in other parts of the brain. Perhaps the emotional centres are in the brain-stem, more particularly in the thalamus. There is some experimental evidence in favour of this conjecture. Certain persons suffering from diseases of the thalamus have shown marked changes in their emotional life. Their sensations were quite normal but the emotions associated with these sensations became disproportionate. "A slight tickling, for example, though perceived as mere tickling, became unbearably painful, and slight warmth which would ordinarily be slightly agreeable became very intensely agreeable. There was in general an exaggerated effect." Also, certain diseases have an effect on the brain-stem. People suffering from one such disease, e.g. sleeping sickness, exhibit changes in their emotional make-up.

Systematic experiments have been conducted on dogs to study this question. Part by part a dog's brain has been removed and its emotional behaviour noted. The removal of the cerebral hemispheres seems to have no effect on its emotional life. But when part of the brain-stem is removed distinct changes are noted in its emotional behaviour. "Cannon and his collaborators have definitely concluded that emotion is therefore a function of a particular part of the brain-stem rather than an experience depending on the sensations of the vital organs and muscles."

12. Methods of Measuring Emotion

There are two ways of arriving at a quantitative estimate of emotion.

1. We may ask the person having the emotional experience to tell us whether it is intense or feeble—this is the method of subjective estimate. He can give himself marks ranging from nought to five according to his estimate of the strength of his emotion. The trouble with this method is that there is no common measuring device which can be used in comparing the emotions of various people. Individual estimates are notoriously variable. An emotional experience of identical intensity may be rated as four by one and as two by another. The subjective method is therefore valuable only as a means of checking up results otherwise obtained.

2. The method of objective measurement. All objective measurements are based on the presupposition that emotions are accompanied by bodily changes. Various instruments have been devised to measure the extent of these changes.

(*a*) *The plethysmograph*. It is believed that as our emotion increases the amount of blood present in our forearm also increases or decreases. The arm is placed in a water-chamber and the disturbances caused by the swelling of the arm is recorded on smoked paper on a kymograph (rotating drum).

(*b*) *The pneumograph*. We have noted that most emotions have immediate effect on the respiratory system. The pneumograph is a kind of belt which is worn round the chest. Changes in breathing are recorded on a smoked drum. The readings obtained are similar to those recorded by the plethysmograph.

(*c*) *The galvanometer*. This is supposed to measure the resistance to electrical energy on the surface of the skin brought about by emotional excitement. Also known as the lie-detector the galvanometer was hailed as a great discovery but has not come up to expectations. "If a small electric current is sent through the body it is found that the resistance of the body decreases with increased emotion. To this change in body resistance the name galvanic skin reflex is applied." Electrodes are generally clapped on the hand and the increase or

decrease of resistance is indicated by a spot of light on a glass screen.

13. Emotion and Sentiment

The management of emotion has been one of the primary concerns of humanity. While it is dangerous to curb our emotions unduly, it is equally dangerous to allow them unrestricted scope. We have so many and varied types of emotion that without some kind of order or system brought in to control them they may easily sink to the level of chaos. It is by grouping emotions into sentiments that we can best control them. The study of sentiments is of recent growth in psychology. McDougall and Shand may be looked upon as pioneers in this field. A sentiment may be defined as "an organized system of emotional dispositions centred about the idea of some object". Thus when some object arouses in us a mixture of two or three emotional traits we may be said to have formed a sentiment towards it. A father, for example, arouses in the mind of the son not only the emotion of love but also that of fear and sometimes that of jealousy. The son thus forms a sentiment towards his father. Most of our emotions are really complex in character, they are sentiments.

Each sentiment has a life history of its own. It is gradually built up and may go on increasing in strength or may decay after some time. When any one of the emotions is repeatedly excited by an object, then the beginnings of a sentiment appear. Suppose a child is in constant company of a very violent tempered man, say her father, whose only approach to her is that of threats and intimidation. At first the child may experience fear at each act of violence but soon it develops a habit of fear in his presence. In his presence even when he is in the mildest of moods the child is afraid. To this simple emotion of fear soon an addition is made, that of anger. The harsh punishments meted out to her rouse a desire for retaliation. Thus round the object of father the emotions of fear, anger, disgust and shame begin to cluster. A sentiment is formed.

Let us analyse some well-known sentiments into their component emotions. Jealousy is made up of love and anger,

bashfulness of pain and the negative self-feeling, and pity of pain and the tender emotion. Our emotions are systematized into sentiments and centre round important objects like parents, church, country, political party, etc. The sentiments of parental affection, loyalty, patriotism and devotion have done much to make our emotional life capable of control.

CHAPTER XIII

INSTINCTS

1. Instincts Compared with Reflexes

We can understand the nature of instincts best by comparing them with reflexes which they resemble a good deal. Like the reflex the instinct is hereditary and unlearned. Like the reflex it is capable of modification through experience. Just as a reflex may be inhibited or facilitated so also an instinct may be changed or suspended by the organism if it is unsuited to its welfare in its original form.

But there are also differences. Reflex activity is typically very quick, often being a matter of mere seconds, e.g. winking. But a train of activity aroused by an instinct may run into hours before it is fulfilled, like the hunger instinct in animals, or even into days and months like the sex instinct in man. Again instinctive activity is fully conscious, whereas reflex action is as a rule automatic and so quick that consciousness rarely enters into it. Further, we are born with all our reflexes ready for action, so to speak, but instinctive activity is dependent on the development of the nervous system and some forms of them may appear fairly late in life, e.g. the sex instinct.

2. Some Definitions

"Instincts represent structurally preformed pathways in the nervous system and stand functionally for affective inherited co-ordinations made in response to environmental demands."—Angel.

"Dependable motives. Activities engaged in for their own sakes and not as means to ulterior ends."—Woodworth.

"An instinct is a series of chained reflexes."—Watson.

"An inherited or innate psycho-physical disposition which determines its possessor to perceive and to pay atten-

tion to objects of a certain class, to experience an emotional excitement of a peculiar quality upon perceiving such an object and to act in regard to it in a peculiar manner, or at least to experience an impulse to such action."—McDougall.

3. McDougall's Theory of Instincts

This theory is well summed up in his definition of instincts just considered. The characteristic feature of his theory is that it co-ordinates instincts and emotions. An emotion is made part of an instinct, its affective side. According to McDougall, instinctive behaviour is purposive behaviour and purpose involves foresight. He claims that instinctive action is response to an object, i.e. several stimuli are put together and apprehended as a single object. It is synthetic activity. He observes "We may say then that directly or indirectly the instincts are the prime movers of all human activity. Take away these instinctive dispositions with their powerful impulses and the organism would become incapable of activity of any kind: it would lie inert and motionless like a wonderful clock-work whose mainspring has been removed or a steam engine whose fires have been drawn". Murphy speaks of McDougall's theory thus: "Each instinct, he held, comprises three parts, cognitive, affective and conative. Men are by nature equipped with a disposition by virtue of which the perception of certain stimuli leads to certain definite and characteristic emotions and these in turn to certain strivings from which motor behaviour follows. Every instinct must contain an emotion as its core. . . . This simplification of the baffling problem of the relation of instinct to emotion attracted much attention and won many adherents."

4. A List of Instincts

Many psychologists have compiled lists of instincts, some very large and some very short. (An attempt has been made to reduce them to two—the instincts of self-preservation and procreation.) McDougall's list is the most well-known and perhaps the most comprehensive. True to his theory, he gives a corresponding emotion to each instinct. Here it is:

Instinct.	Emotion.
1. Instinct of escape.	1. Fear.
2. Instinct of combat.	2. Anger.
3. Repulsion.	3. Disgust.
4. The instinct of appeal.	4. Distress.
5. Pairing instinct.	5. Lust.
6. Curiosity.	6. Curiosity, wonder.
7. Submission.	7. Negative self-feeling.
8. Parental instinct.	8. Tender emotion.
9. Assertion.	9. Elation.
10. Gregarious instinct.	10. Feeling of loneliness.
11. Food-seeking instinct.	11. Appetite or craving.
12. Instinct of acquisition.	12. Feeling of ownership, of possession.
13. Constructive instinct.	13. Feeling of creativeness, of making.
14. Laughter.	14. Amusement.

5. The Instincts of Cleanliness and Adornment

These two instincts are not found in McDougall's list but are recognized by Köhler. It is the fruit of his extensive study of the behaviour of chimpanzees on the island of Teneriffe, off the coast of Africa.

(*a*) *Instinct of cleanliness*. Says Köhler, "I have observed but a single member of the species (chimpanzees) in captivity that was not coprophagous (faeces eating) and yet whenever one of them steps into faeces his foot loses its firm hold just as a human being would in a similar predicament; and the animal then hobbles away until an opportunity is found to cleanse the foot, and in cleansing it the hand is never used, although but a moment ago the same substance was conveyed to the mouth by the hand".

(*b*) *Instinct of adornment*. Köhler found that chimpanzees possessed a tendency to hang all kinds of things on their bodies as adornments. He thinks that "primitive adornment does not depend upon visual effect on others but upon a curious heightening of the animal's own bodily feeling, pompousness and self-consciousness just as is the case with man when he drapes himself with a sash". Children also show similar tendencies.

6. Theories of the Origin of Instincts

(*a*) *The theory of lapsed intelligence*. What are now instinctive acts were originally it is claimed intelligent ones. Since these acts were found highly useful to the organism not only in the struggle for existence but also in perpetuating the species by procreation they were constantly used and became habitual and automatic. These habits were later passed on to succeeding generations as hereditary traits. Instincts were therefore originally deliberate intelligent adaptive acts.

In criticism of this theory it may be pointed out that it taxes our imagination too much to think of our forefathers performing voluntarily the many complicated instinctive activities that we indulge in today. It attributes to primitive forms of organism more intelligence than biological and anthropological evidence seems to justify.

(*b*) *The chain reflex theory*. Originally sponsored by Herbert Spencer it has found a modern exponent in J. B. Watson, the behaviourist. The theory claims that what we call an instinct is nothing but a series of reflexes, each reflex being complete in itself, consisting of a stimulus and a response. But the response of the first reflex may become the stimulus for the second reflex and so on, so that the continuity is kept up and a chain formed. The crux of the theory is its emphasis on the discreteness of stimuli. William James's example of the hungry lion setting out in search of prey illustrates clearly this way of looking at an instinct. "The organic process of hunger touches off the movements of search for prey. The lion begins to stalk the prey as soon as he is made aware of its approach by one of his sensory organs. He springs upon the hunted animal as soon as he comes near enough to it and finally he devours it as soon as his claws and teeth touch it." Thus each movement leads to the arousal of a new stimulus which in turn excites another new movement.

The chain reflex theory emphasizes the affinity between instincts and reflexes. It claims that we should describe instincts with reference to the stimuli that call them forth and not with reference to the ends that they serve. Says Koffka, "When one attributes an instinct of self-preservation to an animal, this description is just as inappropriate as if one were

to attribute to oxygen an instinct to produce rust". It is at this point that we find McDougall protesting. "This account", he says, "is perhaps true as far as it goes and as long as it does not profess to be a complete account and explanation. Instinctive activity does involve perpetual reception of sense stimuli and the consequent sensory excitement into and through the central nervous system and so out along motor nerves and muscles." But when this much is admitted still the explanation of instinctive behaviour is far from complete. For instinctive activity involves perception, the putting together of separate stimuli, apprehending them as a single object and the reaction of the whole organism to this object and not each separate part of the organism to a separate stimulus. As an example of this co-ordinating and purposive characteristic of instincts McDougall takes the behaviour of the earthworm. Place a triangular piece of paper near its hole. The earthworm comes out, feels the paper all over and grasps it by its narrowest part and drags it into the nest. Each stimulus is not reacted to separately but several stimuli are put together and perceived as a single object to which the whole organism reacts.

A serious defect of the chain reflex theory is the failure to explain the close relationship between instinctive acts and the ends they serve. The same instinct may be fulfilled in different ways at different times, according to the nature of the circumstances in operation. In carrying a heavy stick of building material to its nest a bird must make other movements than in carrying a lighter one. At first one course of action may be tried and if not successful a different course may be tried, all aimed at the same goal. The chain reflex theory on account of its purely mechanical nature fails to take into account this phenomenon to which Lloyd Morgan has given the name of "persistency with varied effort".

(*c*) *The theory of organic selection*. This theory visualizes a state when an instinct is in the process of being formed. At this stage things are pretty fluid. A number of tentative responses are made, some of them conscious and intelligent, others reflex and automatic, all directed towards the same end. Those responses that are found beneficial inasmuch as they lead up to the desired end are firmly imbedded in the organism

and those reactions that are useless inasmuch as they hinder the achievement of the end are eliminated. Thus an instinct takes a long time to get fixated and during this period several intelligent acts that have been found useful become parts of it.

This theory seems to combine in itself the characteristic features of the two previous theories. It gives scope for the use of intelligence in the formation of instincts, at the same time gives some explanation of how a series of apparently unconnected reflexes may come to be chained together to serve a definite purpose.

7. Characteristics of Instinct

1. As opposed to learned activities like writing, we are born with our instincts.

2. As opposed to the reflexes which are automatic and unconscious, instinctive activity is deliberate and conscious.

3. Instincts stand for certain fixed and definite ways of reacting to certain types of stimuli. There is no arguing or hesitation about the matter. Given the proper stimulus the instinct concerned comes immediately into play.

4. On the physiological side instincts represent preformed pathways in the nervous system. They are dependent for their proper functioning on the growth of the nervous system and certain other organic changes like the functioning of certain glands. For example, the instinct to walk appears in children only when the nervous system has grown to a certain extent or the sex instinct may fail to appear in its usual complete and urgent form if the gonads or the sex glands are not functioning properly.

5. Instincts are capable of modification through exercise. The first manifestations of any instinct are tentative and exploratory. It is only the repeated exercise of the instinct that enables its owner to achieve proficiency. Successful application ingrains the instinct as a habit; unsuccessful first efforts at fulfilment may retard its growth.

6. The transitoriness of instincts. William James is of the opinion that different instincts appear at different periods of the growth of the organism. If they are not used then and built into the system as habits they may disappear permanently.

The experiments of Yerkes, Bloomfield and Berry seem to support this theory. Yerkes and Bloomfield took twelve kittens, separated them from their mothers and fed them entirely on cooked food. In the second month when they were brought into contact with mice for the first time the characteristic attacking reaction towards them appeared, though they had never seen a cat attack a mouse. Berry performing a similar experiment brought the kittens before mice in the fifth month when they did not show the slightest desire to attack the mice. It looks as though the mice-attacking instinct in kittens comes to the forefront at about the second month and disappears completely by the fifth month if not properly used. It must, however, be pointed out that this phenomenon of transitoriness does not seem to be true of all instincts. The sex instinct, for example, remains with us for life though often not allowed its full natural expression for many years after puberty when it first assumes its completed form.

7. As the nervous system increases in complexity instincts become more and more plastic. The wasp emerges into the world with a ready-made system of instincts. It knows exactly how to build its nest. But in human beings who have a long period of maturation or growth of the nervous system, the same instinct is fulfilled with a variety of minor variations. The instinct is there but it is no longer fulfilled in so immediate and direct a manner as is the case with organisms with simpler nervous systems. Education, convention, custom, religious and moral scruples, all play a part in moulding the manner in which an instinct is to be exercised.

8. Instinct and Intelligence

It is customary to draw a sharp line of distinction between instincts and intelligence. Man is supposed to be a creature of intelligence, i.e. his intelligence has developed at the expense of his instincts whereas in the animal the reverse is supposed to have happened. Bergson has made a theory out of the popular idea of a contrast between intelligence and instinct. He points out that there are three forms of vital impulsion in nature—vegetative torpor, instinct and intelligence. It is wrong to think, he says, that these three represent

successive stages in the development of one and the same tendency. They are really three divergent directions of an activity that has split up as it grew. The difference between instinct and intelligence is not one of degree but of kind. "These two modes of psychical activity above all else are two different methods of action on inert matter. . . . Instinct perfected the faculty of using organized instruments, intelligence in its original form is the faculty of manufacturing artificial objects especially tools and of indefinitely varying their manufacture. . . . Instinct and intelligence therefore represent two divergent solutions to one and the same problem." According to Bergson, as evolution progresses the second solution is chosen more and more at the expense of the first and in man by a leap, the supremacy of intelligence is once for all established.

McDougall is opposed to Bergson's view of the nature of instincts. Intelligence is not a faculty that develops at the expense of instincts. Even in the highest type of organism instinct remains the sole spring of action, though intelligence may come more and more into activity as the modifier or adapter of instincts. They always, it is true, act together in close co-operation, nevertheless it is instinct that makes use of intelligence and not the other way round. Man is therefore as much a creature of instinct as any of the lower animals, though because of his long period of maturation he has learnt to use intelligence in the service of instincts, both in modifying and refining them. But the fundamental springs of all action in man are undoubtedly instinctive.

CHAPTER XIV

IMAGINATION

1. What is Imagination?

Imagination is mental manipulation, the arranging and rearranging in the mind of certain facts perceived. For example, all of us have seen fish and women. These two ideas are put together in a particular combination and we imagine a mermaid. Imagination is possessed by all people though in varying degrees. Perhaps poets and novelists have it to a greater degree than business people. Children are exceedingly imaginative.

It is sometimes contended that there is nothing new in imagination, it being merely a rearrangement of sensory data already gathered. Whether this is true or whether there is some element of novelty in the process it is difficult to say, but it seems to be a fact that as knowledge improves imagination also seems to improve. Murphy points out that during the nineteenth century in Europe, owing to rapid improvements in industrial chemistry our knowledge of colour and its variations was also greatly improved. There was a corresponding improvement in poetic imagery about colour.

2. Free and Controlled Imagination

In free imagination we let our ideas run riot as it were with little regard paid to consistency or probability. This is what we familiarly describe as building castles in the air. Day-dreams are examples of free imagination though there is a slight element of control here. Facts are recalled and arranged into some sort of story in which you are the central figure. We satisfy some desire or other without the actual trouble of execution.

Controlled imagination works within a limited sphere, it sets itself a specific problem which it tries to answer. It starts with certain data and tries to manipulate them in such a way that a desired end is reached. Such controlled imagination is

of very great value in science, and results in the formation of valuable hypotheses. Hypotheses must, of course, be verified by testing them, by seeing that they do not contradict already discovered scientific facts and also by inferring some consequences from them on the assumption that they are true and noting whether the things inferred do actually happen. When the apple fell on Newton's head, he allowed his imagination to get going, he imagined stellar bodies falling in space even as the apple did. Thus was born the hypothesis of gravitation. If the theory of gravitation was true, then certain consequences must ensue which can be actually tested in experience. It stood the test and became a theory which has been accepted by the scientific world.

Controlled imagination working within certain specific limits also leads to invention. Invention is the result of applying the products of imagination to the needs of daily life especially in the fields of industry and commerce. Mr. Singer saw his wife stitching laboriously with her hands; he tried to imagine a machine that could do this job; he slowly thought out the details and the Singer sewing machine was born. Of course an invention to be useful must be marketable, i.e. capable of easy manufacture and sale. Inventing is the *material* outcome of the *mental* process of imagination. Whereas the fruits of our free imagination are not subject to any external criticism, such testing is very essential in both hypothesis and invention. It is easy perhaps to imagine a sewing machine, but quite a different matter to manufacture it on a commercial scale and attempt to sell it.

3. Imagination in Childhood

Children have very good powers of imagination. This is generally revealed in their play. Make-believe games, like playing father and mother or "doctor" require considerable imaginative prowess, as the children have to put themselves in the place of grown-ups and behave as they do. In story-telling, another favourite game with children, imagination is used freely, and fact and fancy are intermixed. In play certain of the children's instincts blocked up by opposition, limitations of environment, or lack of will, are gratified in a new setting

by the use of imagination. The little boy forbidden to use a pen-knife by prudent parents plays the game of bandits where he wears a belt studded with knives of different sizes, which he uses with unrestricted ferocity.

Another way in which imagination manifests itself in play is through *empathy*. Whereas sympathy is feeling for a thing, empathy is a *feeling into* a thing. Much of the joy of kite-flying is due to empathy. The child projects itself imaginatively into the kite, becomes part of it. It is he and not the kite that soars into the skies.

Play in general involves giving familiar objects new meaning and significance, and this cannot be done unless one uses one's imagination freely.

4. Worry

Psychologists have given worry a new significance. It is a kind of indoor game. It is an imaginative substitute for real action, when such action is not possible. The mother worries over her child who has not returned from school at the usual time. She knows she can do nothing about it as the school is far away. But as a substitute for action, she sits and imagines that all sorts of dreadful things have happened to him—he has been run over by a bus, he has fallen into a well, or been kidnapped. When the child returns the mother's joy is doubled, because of the dangers he has escaped.

5. Dreams

Here is a field where imagination can have unrestricted scope. In a dream all day-time standards of decency, decorum and probability are given up. You can do anything you like. The critical faculty is entirely absent. Past ideas are recalled and shuffled and reshuffled into new and fantastic designs. We enter into a state where we seem to have no conscious control over what is happening, the self merely playing the part of a passive spectator to the drama of our thought life. A further characteristic of the dream is its seeming reality while it lasts. When we have an unpleasant dream and wake up, we have a genuine feeling of relief on realizing that it is not true. Yet, though very vivid as long as it lasts, our memory

for dreams is notoriously short and incomplete. When we are dreaming, an actual sensory stimulus, like the ringing of a bell, or the knocking at a door, may break through the barriers of sleep and reach us, in which case it is woven into the plot of the dream and interpreted accordingly. "Maury, an early student of the topic, awakened from a feverish dream of the French Revolution by something falling on his neck, this, under the circumstances of the dream he took to be the guillotine." But more often than not, a dream does not have a plot. Things drift along as one idea suggests another.

6. Why Do We Dream?

Three chief motives may be suggested:

1. *Wish-fulfilment.* In dreams we gratify certain of our desires which we are unable to satisfy due to one circumstance or another. It is quite natural for boys in their teens to be stranded on treasure islands where they discover hidden underground barrels of knives and guns. Sex-starved youths generally shy and tongue-tied in the presence of women dream of sexual orgies on a scale rarely to be met with in reality. "An eminent psychologist has given a dream which he had while travelling in an overcrowded compartment of a European train, with the windows closed and himself wedged in tightly, far from the window. In this uncomfortable situation he dropped off to sleep and dreamt that he had a seat next to the window, had the window open and was looking out at a beautiful landscape."

2. *The mastery motive.* All of us have a desire to get on in this world, to get the better of somebody or other, to be free from irksome restraints and overbearing authority. This desire which psychologists have termed the mastery motive, is the cause behind many dreams. The insignificant clerk dreams of telling the boss where exactly he gets off, the hen-pecked husband of asking his wife to shut up. The mastery motive is also behind dreams of levitation (flying dreams) which are very common. Here the dreamer defies the laws of gravity, thereby demonstrating his superiority over the elemental forces of nature.

3. *Shock.* Unpleasant experiences encountered during the day often tend to appear in an exaggerated form in dreams.

The child who sees a snake during the day dreams of being engulfed in a sea of snakes. The soldier buried alive in a trench and later rescued, dreams repeatedly of being suffocated.

7. Freud's Theory of Dreams

Freud gives an entirely new orientation to the problem of dreams and their interpretation. They do not warn us about things that are going to happen in the future as it was popularly supposed, but they refer to the past, to incidents in the past that we are anxious to hide. He agrees with other psychologists as to the wish-fulfilling nature of dreams, but differs from them in claiming that many such wishes are repressed sex wishes. These repressed sex wishes sink into the realm of the unconscious, but they do not stay peacefully there. They are always trying to come back once again into conscious life. But, says Freud, over the portals of the domain of the unconscious, there presides a censor who refuses to allow all these disturbing sex wishes back into consciousness. However, during sleep, when the vigilance of the censor is somewhat relaxed, they make an attempt to dodge him by disguising themselves as harmless ideas. Thus getting into consciousness, though still keeping their disguise, they have a brief spell of activity. They rush back into the unconscious when the sleeper awakens.

These repressed sex wishes generally adopt certain fixed disguises which Freud calls symbols. A symbol represents an unconscious link between two objects. Because a certain idea is unpleasant to us as it is socially or morally unacceptable, we make another idea which is not objectionable in a similar way, to stand for it, so that when we are thinking of the second idea we are really thinking of the first.

For example, a man falls in love with his neighbour's wife. Society, prudence, religion and morality all tell him that if he goes on with this business he will land himself in great trouble. Therefore the man simply refuses to think about the matter, all ideas concerning his love for his neighbour's wife are repressed. But this is not the end, but the beginning of his troubles. These repressed sex wishes get into the unconscious from where they constantly try to get into consciousness.

But they are foiled by the censor. Then the man has a dream. He dreams that he is driving his neighbour's motor-car. The idea of the neighbour's wife finding that it has no chance of entering consciousness in its original form disguises itself as the neighbour's motor-car. Driving, according to Freud, is a symbol for the sex act. Thus in the dream the repressed wishes regarding the neighbour's wife are carried to the extreme point of consummation, while the dreamer is apparently occupied in doing an innocent task.

The above illustration brings out two more important aspects of the dream. Had the dreamer dreamt directly of his neighbour's wife he would have got up immediately, greatly shocked. The symbolism helped him to sleep on undisturbed. So a dream is the means of preventing the sleeper from being awakened by unpleasant thoughts. A second characteristic brought out by our illustration is that there are two aspects to every dream—the manifest content and the latent content. Driving the car is the manifest content and love for the neighbour's wife the latent content. Freud claims that the latent content represents the true meaning of a dream, though it is not always easy to get at. He claims the credit of being the first man to turn his attention to the latent content. Material for the manifest content is generally got from the important events that have happened during the last few days preceding the dream. They may also consist of incidents from our childhood, trivial in nature and apparently forgotten long ago. But these incidents making up the manifest content must not be taken at their face value—they merely symbolize deeper urges, merely stand as masks for the latent content.

8. Criticism of Freud's Theory of Dreams

Freud's theory has shocked the general public by its frank emphasis on sex. Many have considered it to be too fantastic to be true. The main body of academic psychologists are ready to admit that his theory contains valuable elements of permanent importance to the understanding of dreams. But they are of the opinion that he overdoes both sex and the unconscious (though at the same time they are ready to admit that both these aspects are important and prior to him, much neglected).

It is pointed out that other instincts may figure in the dream besides sex, e.g. fear, pugnacity or the instinct of self-preservation. Freud got most of the material for his theory by analysing the dreams of neurotics. It has been felt that it is somewhat rash to generalize from such data. McDougall refers to various cases that have been reported of people having frankly sexual dreams—the other person concerned being either the dreamer's father or mother or some other socially unacceptable partner. If this be true, it looks as though the elaborate mechanism of symbolism and the censor does not function always. Lastly, our memory regarding dreams is not only notoriously fallacious but also fragmentary. Can any theory based on such memories claim infallibility?

9. Hallucinations

An hallucination is a bit of imagination mistaken for reality. There is no danger in having some fun imagining things as we want them to be as long as we are distinctly aware that they are the products of our imagination, having no counterpart in the objective world, but serious trouble will ensue if they are mistaken for real happenings. If you do this you are having hallucinations, often the first stage of mental disorder.

An hallucination is the projection of a mental image into the outer world, an image mistaken for a sensation. A normal man can easily recognize an hallucination as such, because it does not fit into the objective surroundings. When you sit in your drawing-room and think you see a tiger before you, you are at once aware that your mind is playing a trick on you because a tiger does not very well fit into the civilized trappings of a drawing-room. But insane people ignore the objective surroundings and accept the hallucinations as real. All of us can be deceived into accepting an hallucination as real, if it easily fits into the objective setting. Woodworth gives the example of a man walking past a florist's shop and remarking "What a lovely smell!" The flowers are behind a thick glass window. No smell comes through. It is merely imagined, but it fits so well into the objective picture that he is deceived into accepting it as real.

We must distinguish an hallucination from an illusion. In

an illusion there is actually a sensation before us. We only misinterpret it. In an hallucination there is no sensation at all. An image is projected into the outer world. When we see a rope and mistake it for a snake it is an illusion. When we see a snake when there is nothing at all before us, then it is an hallucination.

CHAPTER XV

PERSONALITY

1. The Individual

So far our study of mental life has been purely analytic. We have considered the various kinds of mental activity, like feeling, will, memory, imagination, etc. Mental traits do not hang in the air. It is the living human person that feels, wills, thinks, remembers or imagines. We shall now consider this person as a unit and not merely as a bundle of traits.

2. Analysis of Personality

We will consider the analysis of personality made by three famous psychologists—Woodworth, James and McDougall.

Woodworth. According to Woodworth a man's personality is made up of the following factors:

(*a*) *Physique*—or bodily development. The mere size of a man affects his attitude towards others and their attitude towards him. The big fellow dominates others easily by virtue of his size and so tends to be good humoured or degenerates into a bully, while the little fellow is apt to be strenuous and self-assertive.

(*b*) *Chemique*—this is the chemical activity, the internal secretions that go on in our body. In ancient days people believed in the theory of humours and tried to relate one's character or temperament with these humours. "Humour" is an old English word meaning a fluid. It was supposed that there were four great humours in the body—blood, bile, phlegm and black-bile. It was thought that character differed in accordance with the predominance of one of the fluids over the others. The melancholy man had a surplus of black-bile or spleen, the phlegmatic man a surplus of phlegm and so on. Modern psychology no longer believes in the theory of humours, but it is coming more and more to believe that the secretions of certain glands of the body may have a vital bearing on the

development of behaviour. The glands in question are the endocrine glands. We have already made some study of these glands. We saw, for example, that the adrenals throw a hormone called adrenalin into the blood. Adrenalin has the power to hasten and strengthen the heart-beat, stimulate the liver and release a lot of stored sugar rapidly into the blood which results in the muscles being supplied with fuel. It seems quite possible that the irritable individual is the one with over-active adrenals. He has too much fuel to burn, too much energy at his disposal. He does not know what to do with it so he lets himself go on the slightest pretext. The exact influence of hormones on character is a matter for further research, but we seem to be on the right track. Those elusive traits of our character which hitherto were put down to caprice or misfortune may have a chemical basis.

(*c*) *Instincts.*—One individual is more social than another or more masterful and aggressive, or more tender and motherly or readier to laugh. These differences make positive contribution to the development of our personality. A man whose gregarious instinct is well developed has what we may call a "jolly" personality, while the person in whom this instinct is under-developed has what is generally called a "shy" personality.

(*d*) *Intelligence.*—A person of limited intelligence is likely to be lacking in such personal traits as tact and sympathy, because he is not able to understand what is going on in social groups. Social perception is a great asset to us, but this is something that has to be learnt carefully. It is a matter of attaching the right meaning to certain signs. The man with limited intelligence is incapable of acquiring this knack. He does not see what other people want and cannot put himself in their place, with the result that his personality is not fully developed on the social side.

William James. James conceives of personality as composed of a series of selves, of which the following are the more important:

(*a*) *Material self.*—A person's material self is made up of his body, clothes, immediate family, home and property. There is a good deal of truth in the saying "clothes make the man". By constant usage they become part of ourselves. A well-dressed

man is self-confident; a shabbily dressed man lacks poise and assurance. Only the truly great can look distinguished and self-possessed in shabby clothes. That clothes gradually become part of our personality is also revealed by the fact that we often tend to judge people by their clothes. For example, we look down upon one who habitually over-dresses as a dandy.

Property also soon becomes identified with the self. When we lose part of it we feel that our personality has shrunk. When the miser is robbed of his gold he cries, "I am lost," and he means it literally.

Our body is ours in a more obvious sense, though as we saw in our study of perception, the child takes some time to discover that it has a body. That our wife and children become part of ourselves is not merely a piece of sentiment. Mutual love, understanding and proximity of living bring about this identification.

(*b*) *Social self.*—We display as many aspects of our social self as there are groups with which we come into contact—home, office, club, church, etc. One may be genial at home, strict at the office, pious at church and a pagan at the club. Fame is nothing but the desire to maintain the reputation of our social selves.

(*c*) *Spiritual se'f.*—This consists of our faculties, dispositions, our ability to argue and discriminate, our moral sensitivities, our consciousness and our will. The spiritual self is the real core of a man's personality. It is his in a much more intimate sense than his material or social self. It is the very essence of man.

The various selves of which a man's personality is composed may have in them characteristics opposed to one another. For example, a man may be a miser as far as his material self is concerned but very lavish as regards his spiritual self—generous in giving advice, freely mixing with people, etc. Besides within one self itself there may be several aspects, some of which may be quite opposed to the others. In this contradictoriness lies a certain attempt at compensation. Characteristics denied to one self or one aspect of a self may appear markedly in another self or aspect of it. Thus a person who occupies a very subordinate position in his office and is

bullied by his superiors may himself develop into a bully at home.

McDOUGALL. According to this psychologist the following traits seem to be the foundation of a man's personality:

(*a*) *Disposition*.—A man's disposition is the sum total of his propensities. McDougall defines a propensity as an innate tendency, what is generally called an instinct. Therefore a man's disposition is made up of all his instincts put together. Woodworth, we saw, also mentions instincts as an essential ingredient in personality. Disposition, however, is not entirely a matter of heredity. Though a man is born with his propensities, these may be either strengthened by exercise or weakened by disuse according to the circumstances of his life, especially according to the way in which he uses them in his childhood.

Each person also differs in the strength of his various propensities. We all have the same number of instincts, but in each certain instincts are stronger than the others. "Some children seem natural gluttons, others more than averagely curious, or timid or tender or self-assertive or docile."

(*b*) *Temper*.—People also differ in the way in which they fulfil an instinct when once it is aroused. A man's temper is characterized by the way in which his instincts work towards a goal when they are in operation. Once an instinct is aroused some people never rest until a goal is reached and some kind of satisfaction is attained. Others are less determined, they are easily discouraged and rarely have strength to carry their instincts to the point of consummation. We may say that the former set of people have a persistent and the latter an unstable temper. In a really well-balanced personality the instincts follow their course smoothly without any undue sense of effort or excitement. Such well-balanced people may be said to have a placid temper. The temper of a man is revealed even in the comparatively simple matter of getting food. Once the hunger instinct is aroused, certain people find it impossible to think of anything else; they must immediately go out and eat at any cost. Others may be silent and hungry for hours together until somebody brings them some food.

(*c*) *Temperament*.—Whereas disposition and temper are

dependent on a man's instincts, his temperament is dependent on certain chemical changes that constantly go on in the body and are accelerated on certain special occasions. This factor is really the chemique of Woodworth. McDougall himself defines temperament as those personal qualities of a man which are determined by chemical influences going on within his body. The most important way in which these chemical influences are brought to play upon the body is by means of the endocrine glands which throw out hormones into the blood stream. For example, secretions of the thyroid gland, known as thyroxin, have considerable effect on a man's temperament. In certain cases where there is a morbid deficiency of this secretion the person concerned is very sluggish in all his activities. On the other hand, excess of thyroxin in the blood produces a general state of over activity and irritability of the nervous system.

Chemical changes may also be brought about as a result of the body working and using up energy. "Practically every activity of the organism is in a sense work. The circulation of the blood, the digestion of food, the lifting of a weight, the multiplication of one number by another—all these use up energy in producing their result. One result of the body using up energy is that waste products are produced in the nerve cells, at the synapses, or at the end-plate where nerve and muscles join, at a more rapid rate than they can be eliminated." These uneliminated waste products in the body produce fatigue.

McDougall suggests that fatigue is a factor that affects temperament. Persons differ in respect of their susceptibility or resistance to fatigue. Of two men that work at a given task equally vigorously at the outset, one may show marked signs of fatigue much sooner than the other. The temperament of these two people is bound to be different. The former may be a strong man of action, the latter may degenerate into the theorist, who has very little energy for action.

(*d*) *Character.*—Character is a term extensively used in literature and popular language and therefore has acquired a wide range of meanings. There is, however, one element common to all these meanings, that is the recognition of the fact that character is something that is gradually formed within

the child or youth and that the process is greatly influenced by the type of society with which the individual comes into contact. Those who do not believe in the influence of environment on the mind naturally look upon character as a myth, but all others agree that character is real and is a slow growth. That is why we have the phrase "the moulding of character". We also associate character with morality, our ideas of right and wrong, our sense of justice and the tenacity with which we hold on to our ideals. Personality has a moral aspect to it; a man's behaviour is influenced by the things he believes in, the things that he considers worth while. Common sense is therefore undoubtedly right in stressing the influence of character on our personalities.

McDougall considers character to be "something within us which expresses itself in volition, in the higher forms of action and in the control of action, something which since it gradually takes shape within us in the course of the battle of life and since it is liable to disintegration, must be a complex organization". He would say that a man's character is dependent on the type of sentiments that he has. Our emotions tend to group round certain objects like father, country, etc., and each such system of emotions is called a sentiment. Sentiments are further grouped round a super-sentiment. A man's character and ultimately his personality is greatly influenced by the type of super-sentiment that he has. The personality of the man whose super-sentiment is God will naturally be different from that of one whose super-sentiment is money.

The analysis of personality made by these three famous psychologists all throw into relief one important fact about it—that it does not refer to any one particular sort of activity, but an individual can reveal his personality in the way he performs almost any activity. When we think of a man's personality we have in mind some total quality of his behaviour, how he acts when his activity is taken as a whole.

3. Multiple Personality

In multiple personality the different selves, the different aspects to our personality break loose as it were, and become independent autonomous units. Each self or system of ideas

becomes a completely self-sufficient unit and when one such self takes possession of a person's consciousness, the other selves are driven out into the realm of the unconscious. Thus a person suffering from multiple personality is not aware of that fact.

The most common form of multiple personality is dual personality, but there can be triple personality and cases have been reported where even four personalities have lived together in the same body. In a dual personality (we shall take this form as typical) the usual or the more lasting state of the individual is known as the primary personality, while the state into which he occasionally lapses is known as the secondary personality. As a rule, the individual is incapable of remembering in his primary state what he did in his secondary state, but in his secondary state he remembers what he did in his primary state, but is liable to speak of it as done by another person. This fact has been proved by Morton Prince. He was able, by means of a process resembling hypnotism, to make his subjects pass from one personality to another and back again. One of his subjects, a young woman, was given a short problem in arithmetic while she was in the primary state and was then put into the secondary state, whereupon she immediately shouted out the answer.

When there are more than two personalities in an individual these personalities do not form a hierarchy. A person does not first get into the secondary personality, then into the third and so on. The primary personality is the basic one. From this the individual sometimes lapses into the secondary, sometimes into the third or fourth personality, as the case may be. But usually he returns direct to the primary personality.

4. Dissociation

We saw that all of us have two or three sides to our personality. Why should they split up into separate units and become independent? Dissociation is the name given to this process of splitting up. We find that very often the cause of dissociation or cleavage between two personalities is some violent shock. But once the cleavage is established, the person passes from one state to another almost imperceptibly and

without any adequate reason. Woodworth gives us the case of a dual personality in a girl which started when she was three years old. At this time she was thrown on to the floor by a drunken father, who found her sleeping on his bed one night. From that moment the child developed two personalities, the primary one being serious and industrious and the secondary frolicsome and mischievous.

The psycho-analysts are of the opinion that repression is one of the chief causes of dissociation. Repression is the process by which undesirable or unacceptable ideas are forcefully thrust into the background of the mind—the unconscious. Freud claims that these repressed ideas are not completely annihilated but only deprived of their normal function. A number of such repressed ideas, all imprisoned within the unconscious, may join together and become a little system, which is self-contained and completely cut off from normal consciousness. When this happens we have the phenomenon of dissociation and the ground is ready for the formation of a multiple personality. When such a system comes into consciousness the primary stream of consciousness entirely disappears and the subject is for all practical purposes a different person.

5. Popular Misconceptions Regarding the Nature of Multiple Personality

(1) Of the two personalities one must be good and the other bad. The changes in personality need not necessarily have any moral implication. Both the personalities may be either good or bad. Nevertheless, it is true that very often the different personalities reveal a certain attempt at compensation, the secondary personality possessing characteristics that are denied to the primary one.

(2) Changes in personality are accompanied by changes in the physical features of the person concerned. This idea is closely concerned with the moral implications of multiple personality. When a man passes from a personality which is good to a personality which is wicked there is it is believed a corresponding change in his physiognomy. Such a belief has no foundation in reality at all. The face is no more an

index to the mind in multiple personality than it is in ordinary personality. A man may pass on from a saintly to a wicked personality and look benign all the time.

(3) That the occasion for passing from one personality to another is always a violent shock. We have already noted that very often it is some very violent shock that starts the process of dissociation. But it is not true that every time an individual passes from one personality to another he must have had a violent shock. Once the dissociation is established a man may pass from one personality to another without any ostensible reason.

6. Mental and Nervous Disorders[1]

Multiple personality is an abnormality. It is one of the disorders to which the human personality is liable. When dividing mental and nervous disorders into neat little groups with distinctive labels, we must bear in mind that this is done for the sake of clearness of exposition. The groups "run" into each other. The same person may exhibit symptoms characteristic of more than one group.

Broadly speaking, mental and nervous disorders are of two types, psychosis and psychoneurosis. Psychosis is a disorder of the mind leading to "social maladjustment necessitating institutional care". Psychoneurosis is what is popularly called "nervous disorder". But this distinction between "mental" and "nervous" should not be pressed too far. All nervous disorders are also mental disorders. The nervous system cannot be thrown out of gear in isolation. Automatically our mental life is involved. A psychosis need not necessarily have a physical cause in the brain or anywhere else. Though in certain cases like the general paralysis of the insane such a cause may be present, in other cases like mania it is not. Conversely, "disease of brain can exist without disease of mind".

Kinds of psychoneurosis

(*a*) *Phobia*—"an irrational fear recognized by the victim as irrational and called into being by a specific stimulus". The

[1]I am greatly indebted to Millais Culpin's *Mental Abnormality* in the preparation of this section.

victim knows that his fear is groundless but is unable to do anything to overcome it. In cat phobia, for example, a person knows that it is silly to be frightened of a cat but yet cannot help being so. Such fears are often merely the symptom of some deeper nervous trouble and do not disappear until the underlying causes are removed.

(*b*) *Obsessional symptoms*. Here the patient feels that certain harmful ideas or acts *thrust* themselves upon him. They can only be resisted by a great effort of the will—the whole process being extremely unpleasant to the sufferer. One form that obsession may take is unnecessary and exaggerated doubt. "The doubts that assail these people seem ridiculous, but they are very real to the sufferers; one man cannot post a letter without returning to make sure that he has not dropped it on the ground instead of putting it into the letter-box, another must always open a letter he has sealed in order to make sure that he has said nothing absurd in it. Many of us have these tendencies but the obsessional must give way to them or suffer anxiety."

(*c*) *Dissociation*. We have already discussed dissociation in an earlier part of this chapter. Dissociation is the state where a part of our mental life breaks away from the main stream of consciousness and becomes relatively independent. Such breaking away may result in many forms of psychoneurosis like hysteria, somnambulism or a fugue. Hysteria manifests itself in a variety of ways. The patient may go into a trance-like state, indulge in a train of activities and then come back to his normal conscious life, or he may claim that a certain part of his body is paralysed while physically it is quite sound. In somnambulism or sleep-walking, as it is popularly called, a person goes through a series of activities without being aware of his surroundings. In a fugue, there is full awareness of surroundings, but the series of activities lasts much longer than either in hysteria or somnambulism. In fact the sufferer takes on a new personality, lives it for a certain time and then comes back to his original state.

Kinds of psychosis

(*a*) *Melancholia*—in its simplest form is characterized by

"periods of a mild depression that may not interfere seriously with the patient's activities". The patient generally blames himself for them. As these periods increase in severity he may attribute a cause to it—either a real or imaginary deed that he has done. Gradually he works himself into a delusional state and thinks all his trouble is due to his having committed some unpardonable sin. He becomes more and more care-worn and develops a tendency to sit and mope all day. There is full awareness of his condition and often a desire for treatment.

(*b*) *Mania*—"is marked by an unstable mood of elation, a rapid flow of ideas, and a combination of excessive mental and physical activity". Maniac symptoms may be mild or severe, there being an infinite number of gradations—from "high spirits" to "raving lunacy". Unlike the melancholic, the maniac has no insight into condition and hence is socially more dangerous.

(*c*) *Schizophrenia*—"is a steady deterioration of the personality, usually starting in adolescence, and involving disorder of feeling, conduct and thought". This illness develops slowly. The patient gradually begins to live in a dream world of his own. This world becomes more and more real to him as he begins to lose contact with what others call the real world. His actions show a certain amount of consistency but can be understood only in relation to his world of phantasy, e.g. a young man who claimed the right to travel without tickets because he was the representative of the Almighty on earth.

(*d*) *Paranoia.* This has certain affinities to schizophrenia, but there is a lack of strongly marked emotional disturbances. The sufferer has a group of false ideas like that of being persecuted. No amount of argument will serve to disabuse him of these ideas. In other respects he is quite normal. Though generally in paranoia the delusions centre round persecution, sometimes they may be grandiose, e.g. thinking that he has royal blood in him, hence is entitled to certain privileges.

7. Methods of Curing Mental and Nervous Disorders

There are several methods of psychological healing of which the following are the best known:

(1) *Suggestion.* Here we make a man adopt a plan of action on the authority of somebody he loves or respects, without examining it or criticizing any part of it. This is one of the oldest methods of mental healing and is extremely effective when cleverly used. Many mental disorders are due to wrong ideas or unreasonable fears that the victim has somehow picked up. Such disorders can be cured by counter-suggestion. "Any means that contribute directly or indirectly to the building up in the minds of patients a feeling of assurance that a cure is on the way has all the power of suggestion and contributes materially towards a cure."

(2) *Auto-suggestion.* The principle of suggestion has been very effectively used by Coué. In his system, however, suggestions do not come from the outside but from the man himself. The patient suggests to himself certain ideas that have a curative value. "Auto-suggestion puts a person into an attitude that favours attention to the things that will actually make him better." One of Coué's famous phrases is "Day by day in every way I am getting better and better". Repeating such a phrase several times first thing in the morning suggests to the patient the advisability of constantly thinking about the more hopeful aspects of his life and conversely prevents him from moping too much about the darker side.

(3) *Hypnotism.* This is a process by which an individual is made to lose his consciousness of his surroundings except in one respect, i.e. his relation to the hypnotizer. The patient has no will of his own, it having been completely surrendered to the person under whose hypnotic influence he has come. In this condition he is in an extremely suggestible state. "When under the hypnotic trance certain ideas are put into the patient's mind which have a definite curative effect, or certain other ideas, which have had a bad influence on him, are removed."

(4) *Psycho-analysis.* Of all the methods of healing connected with psychology, psycho-analysis is the most famous and the most widely used. The characteristic features of this method are the creation of the two Austrians, Breuer and Freud. The latter studied in Paris, where for a long time eminent French psychologists like Charcot and Janet had made a special

study of mental and nervous diseases. Charcot had studied functional nervous disorders like hysteria and had come to the conclusion that in most of these cases the root cause of the trouble was psychological. Janet continued this line of research and used hypnosis in his investigation of such cases.

The psycho-analytic movement carried further the work begun by the French school. The first significant discovery made by Breuer was that certain intensely emotional experiences, because of their unpleasant nature, may be violently suppressed. Such experiences do not entirely disappear, they stay in the realm of the unconscious whence they indirectly influence thought, feeling and action, and are often the cause of mental and nervous disorders. The psycho-analyst, as we have already noted, gives exactly the same explanation of the dream mechanism. The unconscious is not a new idea in psychology. Philosophers like Hartmann had referred to it long before Freud. But the philosophers had always approached it from the point of view of knowledge. The psycho-analyst approaches it from the point of view of emotion. It is the great store-house of repressed emotional experiences. The unconscious is not a thing but a methodological device, by means of which a complete explanation of the mind is given and gaps in conscious life accounted for.

The cure in such cases lay in bringing back into consciousness these experiences so that they may have free scope to get rid of their excessive emotional characteristics. But many of the patients often forgot what those experiences were. Breuer had used hypnotism to make them recollect the past. Freud, however, gave up the use of hypnotism because only certain types of patients could be hypnotized and even in these cases the deeper layers of the unconscious where the real source of trouble lay, were left untouched. Freud made use of the method of free association instead. Also known as the talking cure and sometimes humorously referred to as the method of chimney sweeping, the method of free association consists of encouraging the patient to talk out freely everything that comes to his mind, however trivial, intimate or indecent it may appear to be. In thus completely pouring out his thoughts without any reserve, he is supposed to relive his past and in

reliving it learn to overcome the evil influence of such parts of it as were unpleasant. "This procedure", remarks Flugel, "obviously has some resemblance to the rite of confession as practised by the Roman Catholic Church (though free from its moral and theological implications) and, going further back, to the function of tragedy as expounded by Aristotle, who taught that tragedy produces a healthful purging of the soul by an intense arousal of the emotions of pity and terror."

Other sources from which material can be gathered for detecting the cause of trouble in a patient are the analysis of dreams and the investigation of the motives underlying the trivial acts of negligence or lapses of memory that are common to most of us. Freud investigates this phenomenon, to which the name of parapraxia is sometimes given, in his book *The Psychopathology of Everyday Life.*

Freud is of the opinion that the pathogenic or disease-producing experiences that have been repressed are all sexual in nature. Sex therefore plays an important part in psycho-analytic theory. Freud's theory of sex is an extremely complicated one. Sex, according to Freud, fulfils needs far and above that of reproduction. Its ramifications are many and varied. It is, however, important to note that Freud gives to the term a connotation much wider than the conventional one. Sexual pleasure is not restricted to the series of acts preceding and resulting in reproduction but is made to cover any kind of sensuous pleasure. Freud suggests that a person's sexual development is in three stages:

(1) The auto-erotic stage—when sexual pleasure is derived from different parts of the body, independent of each other. Such parts of the body, known as the erogenous zones, are the mouth, anus, muscles, genitals, eyes, ears, the urethra and the skin.

(2) The narcissistic stage—when the sexual energy or the libido is directed towards one's own self and

(3) The stage of object-love—when the erogenous zones, instead of acting independently, are brought under the hegemony of the genital organs and are made to serve the interests of reproduction. In this stage the libido is directed towards a person of the opposite sex.

11. Personality Types

Psychologists have been taking increasing interest in the question of personality types. But it must be confessed that as yet no satisfactory and completely scientific basis for classification has been reached. Francis Galton was one of the earliest workers in the field and he used as the basis of his classification, the kind of mental imagery that people had. He classified them into "audiles" (people who had mainly auditory images), "visiles" (people who had mainly visual images), "tactiles" (people who had an excess of tactual imagery) and so on. The defect of this classification is that we constantly come across people who do not fit into any of these classes as they have no pronounced preponderance of any one type of imagery.

Another investigator, Kretschmer, distinguishes four main types. 1. Asthenic (tall and thin, like the chimpanzee). 2. Athletic (with strong skeleton, broad chest, powerful muscles, suggestive of the gorilla). 3. Pyknic (short and broad showing some resemblance to the orang-outang), and 4. Dysplastic (a sort of intermediate category).

The German psychologist, E. R. Jansech, suggests a twofold classification, B and T standing for Besedowoid and Tetanoid. Like Galton he uses imagery as the principle of differentiation. The B type of people have very good eidetic images, i.e. memory images which when recalled have all the vividness of original perceptions while the T type have very poor ones.

Another recent classification, due to R. B. Cattell, is that of "surgent" and "desurgent". A typical surgent temperament is cheerful, social, humorous, tactful, fertile in imagination and rather forward in social life. The desurgent type is unsociable, reserved, slow in thought, tactless and shy.

But undoubtedly the most popular contribution to typology has been that of Jung, who divides people into introverts and extroverts. An introvert "is an individual in whom there exists an exaggeration of thought processes in relation to directly observable social behaviour, with the accompanying tendency to withdraw from social contacts". An extrovert "is an individual in whom exists a diminution of thought processes in

relation to directly observable social behaviour, with an accompanying tendency to make social contacts".

It is no doubt convenient to classify people into types. It is a great help to us in our social life, if we are able to roughly classify persons into particular character groups. Yet we should not exaggerate the importance of any of these classifications. The criticism offered against Galton's classification is true of all other attempts also. As yet no types have been discovered which would hold good under all circumstances. Again and again persons turn up who seem to belong to intermediate types. Yet others seem to exhibit at certain times the characteristics of one type and at certain other times that of another.

We have now come to the end of our attempt to study the human mind. A little learning is not always dangerous and it is hoped that the little that has been said here may spur the readers' curiosity and make them eager for fuller knowledge. This has been a simple and straightforward account of what psychologists have done and hope to do. The human mind is an extremely complicated thing and progress in understanding it must necessarily be slow. In comparison with the massive and spectacular advances made by other sciences, the achievements of psychology may appear puny, but let us remember that in trying to understand the human mind, we are concerned with the very basis of all human activity. Let us take courage in the fact that though our progress may be slow, it is real, and that every step forward brings us nearer towards building a better world order—for thoughts and ideas are translated into the actions that govern the world.

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